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INDUSTRIAL MEDICINE AND SURGERY

AUGUST, 1958

Evaluation of Conjugated Nitro-olefins As Eye Irritants in Air Pollution

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Los Angeles smog frequently contains lachrymators of unknown composition, presumably at low concentrations. It is probable that these lachrymators are formed by photochemical reaction of less irritating components of the smog. Since conjugated nitro-olefins were thought to be potent lachrymators, and since major contaminants in the Los Angeles atmosphere include oxides of nitrogen as well as olefins and other hydrocarbons, a cooperative study of the eye-irritation potentials of some of these nitro-olefins was undertaken, involving the University of Miami and the Los Angeles County Air Pollution Control District (APCD).

As part of a pharmacological study of these compounds in the range of C_4 to C_9, 2-nitro-2-butene, 2-nitro-2-hexene and 2-nitro-2-nonene were synthesized at the University of Miami, and samples of the first two were sent to the APCD laboratories in Los Angeles. They were then subjected to a joint study of the threshold concentrations of these compounds capable of producing eye irritation. The 2-nitro-2-nonene was studied only at the University of Miami.

The investigation at the University of Miami was conducted by a research contract from the Air Pollution Medical Program of the Public Health Service, U.S. Department of Health, Education, and Welfare.

Experimental Procedures

AT UNIVERSITY OF MIAMI: The exposures were made in a sealed chamber of 500 liter capacity. The material to be studied was dissolved in a volume of carbon tetrachloride which was as small as possible but which permitted convenient handling of the sample. The sample was introduced into the chamber and volatilized by an internal fan. Prior to exposure, the air circulation was stopped and the temperature inside the chamber noted. The subject was exposed by placing his eyes and nose inside a skin-diving mask fitted to the chamber. The subject activated an electronic stop-watch when the shutter between the mask and chamber was released and stopped the watch at the detection of eye irritation. A nose clip was placed on the subject so that odor would not be a determining factor in the procedure. The concentrations of nitro-olefins

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to which the subject was exposed were random. There were no responses to no-sample controls.

AT LOS ANGELES: One-fourth ml. of the substance was placed into an evacuated five-liter flask and, after warming for about five minutes, the vacuum was released. Various aliquots of the vapor phase of the substance were then transferred to 50-liter flasks which had been preheated to 70° C. Exposures of the eyes of individuals to the contents of the flask were begun when it had cooled to 60° C. The elevated temperature has been found, in other studies, to reduce the exposure time to first sensory response presumably by assuring more rapid convective transfer of the irritant to the receptor. The subject was exposed by placing his eyes against an eyepiece which connected with the 50-liter flask when a separating slide was removed. He signaled his first detection of eye irritation, and the time was recorded accurately. Each mixture was tested by a panel of from six to 11 subjects.

Comparison of Results

THE RESULTS obtained at the University of Miami are set forth in Tables I, II, and III for 2-nitro-2-butene, 2-nitro-2-hexene, and 2-nitro-2-nonene. The results of the APCD are summarized in Tables IV and V, for the first two of these compounds, respectively. Comparison of the results leads to the following conclusions: (1) The eye irritation produced by equivalent concentrations of 2-nitro-2-butene and 2-nitro-2-hexene was of the same order of magnitude by either method. The threshold for eye irritation as found by the University of Miami group appeared to be about 0.2 to 0.4 parts per million for the nitro-hexene, compared with about 0.1 found by the APCD method; for nitro-butene, the former group found the threshold to be less than 0.2, while the latter found it to be less than 0.1. The differences are reasonably attributable to the differences in techniques. (2) The threshold for the 2-nitro-2-nonene is apparently considerably higher than for the other compounds.

TABLE I.
SUMMARY OF RESPONSE TIME FOLLOWING EXPOSURE TO 2-NITRO-2-BUTENE (UNIVERSITY OF MIAMI)

Concentration			Number of Individuals Exposed	Response Time (Seconds)		
Parts per Million	mcg. per liter	moles per liter X 10^{-8}		Minimum	Maximum	Mean
2.2	10.0	10.0	10	12.9	33.9	21
1.7	7.5	7.5	10	20.4	70.8	37.4
1.1	5.0	5.0	5	25.2	38.4	30.7
0.6	2.5	2.5	5	46.5	87.5	68.3
0.2	1.0	1.0	5	107	190	133

TABLE II.
SUMMARY OF RESPONSE TIME FOLLOWING EXPOSURE TO 2-NITRO-2-HEXENE (UNIVERSITY OF MIAMI)

Concentration			Number of Individuals Exposed	Response Time (Seconds)		
Parts per Million	mcg. per liter	moles per liter X 10^{-8}		Minimum	Maximum	Mean
1.73	10.0	7.7	10	20.2	44.7	25.0
1.30	7.5	5.8	5	23.7	65.1	41.6
0.85	5.0	3.8	5	50.8	70.2	49
0.43	2.5	1.9	5	63.7	109.2	91.3
0.17	1.0	0.7	10	—	—	180 [1]

[1] See Text.

TABLE III.
SUMMARY OF RESPONSE TIME FOLLOWING EXPOSURE TO 2-NITRO-2-NONENE (UNIVERSITY OF MIAMI)

Concentration			Number of Individuals Exposed	Response Time (Seconds)		
Parts per Million	mcg. per liter	moles per liter X 10^{-8}		Minimum	Maximum	Mean [1]
1.95	15.0	8.7	5	138	171 [2]	148
1.30	10.0	5.8	12	153	275 [3]	250
0.65	5.0	2.9	6	—	—	no response

[1] Not including nonresponding individuals.
[2] No response, one individual in 180 seconds.
[3] No response, three individuals in 300 seconds.

TABLE IV.
SUMMARY OF RESPONSE TIME ON EXPOSURE TO 2-NITRO-2-BUTENE (APCD METHOD)

Concentration			Number of Individuals Exposed	Response Time (Seconds)		
Parts [1] per Million	mcg. per liter	moles per liter X 10^{-8}		Minimum	Maximum	Mean
10	45	45	4	4	5	4.5
1.0	4.5	4.5	11	6	17	8.7
0.2	0.9	0.9	10	9	44	24.6
0.2	0.9	0.9	7	11	60	24.3
0.1	0.45	0.45	8	24	60	51.1
0.05	0.22	0.22	4	>60	>60	>60

[1] Nominal concentrations, listed here, are greater than those actually used by an indeterminate factor, due to incomplete evaporation.

TABLE V.
SUMMARY OF RESPONSE TIME ON EXPOSURE TO 2-NITRO-2-HEXENE (APCD METHOD)

Concentration			Number of Individuals Exposed	Response Time (Seconds)		
Parts [1] per Million	mcg. per liter	moles per liter X 10^{-8}		Minimum	Maximum	Mean [1]
0.60	3.5	2.7	10	5	23	10.8
0.48	2.8	2.1	7	7	23	13.4
0.36	2.1	1.6	8	6	24	14.1
0.36	2.1	1.6	7	10	40	15.0
0.24	1.4	1.1	7	7	25	16.6
0.24	1.4	1.1	10	6	46	14.7
0.12	0.7	0.54	7	11	45	23.1
0.06	0.35	0.27	6	47	>60	>60

[1] Nominal concentrations calculated assuming a vapor pressure of 1.0 mm. Hg for 2-nitro-2-hexene. and assuming that the vapor reservoir was saturated with the compound.

Comment

THE QUANTITATIVE discrepancy between the results as reported by the two laboratories which may be estimated as a factor of two to four in the threshold concentration, is in the direction expected on the basis of the increased temperature of the APCD mixtures and, more important, the increased convection at the eyepiece.

The irritating action of the nitro-olefins is evidently directly upon the sensory nerve endings of the cornea. At low concentrations, the me-

chanical washing of the eye during blinking produces a "now I feel it — now I don't" response. In one instance, in the determination of the response time to a 1.0 mcg. per liter concentration of 2-nitro-2-hexene, this "washing phenomenon" made an accurate measurement impossible.

A flow of air within the chamber markedly decreased the time required to produce eye irritation at any concentration of a nitro-olefin. This effect may be due in part (or totally) to one or more of the following factors: drying of the conjunctiva, disposal of material condensed on the surface within the chamber, and/or increased rate of delivery of irritating substances to the conjunctival surface.

It was noted that individuals who had been repeatedly exposed to nitro-olefins over a sustained period became increasingly sensitive to the eye-irritating effects of these compounds.

Temperature, within the limits of 65°-90° F, apparently had no influence upon the sensitivity of the eye to a nitro-olefin.

The deterioration of the samples used by the APCD was evident on repetition of these tests after a storage time of about two months, when mean response times were much increased for both compounds.

Brief ultraviolet irradiation also rapidly destroys the lachrymator, as evidenced by several tests with the 2-nitro-2-hexene in the 50-liter flasks used by the APCD.

Conclusions

DISTINCT eye irritation owing to 2-nitro-2-olefins at low concentrations in air has been observed by two laboratories. For the butene and hexene derivatives, concentrations between 0.1 and 0.5 parts per million by volume have been shown to produce irritation within three minutes. For the corresponding nonene, irritation was observed only at concentrations above 1.0.

Crisis Medicine

EVENTS of the past few years and particularly of the past few months make us wonder. Are we entering a new era of medical practice — an era of "crisis medicine" practiced on a nationwide scale? Our profession has a long tradition of conservatism or caution, if you will, which has been frequently a source of irritation to some within and without the profession, but has been accepted generally as being in the best interests of all. Perhaps at times we lag in the adoption of newer methods and in acclaiming new discoveries but the record shows that most of the great advances in medicine have been accepted and implemented very quickly by the profession at large. These advances have "sold" themselves without any large-scale propaganda — professional, commercial, political, or otherwise. Now we seem to be witnessing a new trend. Not too long ago the Salk vaccine was introduced to the nation on a coast-to-coast television hook-up with no preliminary briefing for the average physician. Overnight, profession and public alike were bombarded with pressures from many sides for immediate immunization on a massive scale never known before. Within a few weeks some tragedies occurred; within a few months control and production methods were being re-examined and altered. Even today, although we all feel that the Salk vaccine represents a tremendous medical achievement, questions as to optimum dosage, duration of protection, ideal methods of production and control still remain to be answered. More recently we see a more disturbing phenomenon: the United States Public Health Service has gone "all-out" in promoting immediate immunization of millions of people against an apparently mild form of influenza which most unfortunately has been labelled officially "Asian" — a name that seems to have horrible connotations for the uninformed layman. We do not doubt the benevolent intentions of our public health people or their sincere belief in the efficacy of these methods. However, it is not in the tradition of medicine and if this represents a new era we can only wonder what lies ahead. Perhaps we shall soon have a surgeon-general for the world making his headquarters in "Sputnik" or some American improvement of same, spinning round us every hour on the hour and calling the "shots" as he whirls. For, to say the least, our people are becoming all too "shot-minded."

—From *Westchester Medical Bulletin*, February, 1958.

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World-Wide Malaria Eradication

PAUL F. RUSSELL, M.D.
The Rockefeller Foundation

MANY occupations may predispose to malaria by increasing the contact between man and the mosquito vector. In tropical areas, particularly, the employees of tea gardens, rubber estates, sugar haciendas, hemp plantations, logging and mining companies, builders of dams, highways, and railways, have been subject to severe malaria. For example, not until malaria was controlled on the estates, could the rubber industry be developed in Malaya. Even today in central Africa and certain other areas of the world, malaria is to a large extent an occupational disease. Clinically, of course, malaria in industrial communities presents the same picture as in any other community. But there are large differences in economic and social aspects. There is a good discussion of industrial malaria in "Industry and Tropical Health III" published in 1957 by the Harvard School of Public Health.

SIR WILLIAM OSLER (1923) thirty-five years ago wrote: "I think, if a census were taken among the world's workers on disease, the judgement to be based on the damage to health and on direct mortality, the votes would be given to malaria as the greatest single destroyer of the human race." Twenty years ago, Williams (1938) estimated the average incidence of malaria in the United States as four million cases a year, with as many as six or seven million in peak years, such as 1935. But in 1957, the total number of malaria cases reported in the United States was only 144 (provisional; Dunn, 1957).

Six years ago, after considerable study, I estimated that the number of malaria cases in the world annually totalled about 350 million, with 3.5 million deaths (Russell, 1952). Recently, I have again reviewed available data and have estimated that approximately 200 million cases occurred in 1957, with 2 million deaths. Still a huge total, but it seems likely that the world incidence of malaria has been lowered by more than 40% since 1952. The disease has been practically eradicated from a score of countries represented by Venezuela, Italy, Mauritius, Taiwan (Formosa) and the United States.

Beyond doubt, malaria is in full retreat and today we talk with confidence of the world-wide eradication of this "King of Diseases." Such a goal greatly stimulates the imagination, giving rise to hopes and doubts and many questions.

The Delta Omega Lecture, School of Public Health, University of Michigan, Ann Arbor, Michigan, February 11, 1958.

Definitions

ACCORDING to the Expert Committee on Malaria of the World Health Organization (1957): "Malaria eradication means the ending of the transmission of malaria and the elimination of the reservoir of infective cases in a campaign limited in time and carried to such a degree of perfection that, when it comes to an end, there is no resumption of transmission." Malaria eradication is not synonymous with vector eradication. The latter requires the elimination of one or more species of Anopheles from a given area, a task that usually is not feasible and that fortunately is not necessary to bring malaria transmission to an end. Moreover, malaria eradication is not the same as malaria control. For example, malaria eradication aims to stop all transmission in a short time, usually in three to 10 years, whereas malaria control can rarely do more than curtail transmission, even after 25 to 50 years. Malaria control deals with areas of importance that are easily accessible, while malaria eradication undertakes to stamp out every focus of transmission, however unimportant commercially or remote in location. Control is acceptable if it removes malaria from the list of major public health problems in an area, but eradication is not satisfactory unless it completely interrupts transmission throughout the area. In malaria control, case finding has secondary importance but in eradication it is essential to require notification of cases and to seek out and treat all who are infected. These and other differences imply a new point of view and sharper tools. Annual costs may be somewhat higher at first but the money spent may properly be viewed as capital investment and not as a continually recurring expense.

History

THE STORY of man's attempts to master malaria is notable in the annals of preventive medicine (Russell, 1955). In fact, as Osler (1923) said: "No disease illustrates better the progressive evolution of scientific medicine." The disease has been known from the very beginnings of history,

recognizable by the uniquely intermittent bouts of chills, fever, and sweating, clearly described by ancient Indian, Chinese, Greek and Roman observers. Of course, other fevers were and to this day are confused to some extent with malaria. But the intermittent quotidian, tertian, and quartan fevers stood out more clearly than most diseases.

At a very early date these intermittents were etiologically linked with swamps and marshes. In fact, we may properly say that the first major discovery in reference to malaria was that the drainage of marshes sometimes lowered the incidence of fevers of nearby populations. What seems to be the oldest account of this sanitary practice is in the story of Hercules and his sixth labor which tells allegorically of his draining the Stymphalian Marshes in Greece. Greeks and especially Romans constructed many drains for agricultural and hygienic purposes and, ever since, drainage has helped to reduce the incidence of malaria over the world.

The second outstanding discovery regarding malaria was made at the beginning of the 17th Century when Spanish colonials in Peru observed that the bark of a tree, later called Cinchona by Linnaeus, had specific curative powers against the intermittent fevers. Thereafter, for nearly 350 years, cinchona bark and its principal alkaloid, quinine, had world-wide use in the therapy and prophylaxis of malaria, greatly reducing the mortality in many areas. Moreover, the bark provided a practical way of separating the true intermittents from other fevers not affected by the alkaloid.

The third great discovery was by Laveran, a French Army surgeon, who in 1880 found malaria parasites in the blood of a patient at the Military Hospital in Constantine, Algeria. This was not an accident but the result of painstaking studies. Laveran had undertaken to track down the source of malarial pigment, attributed at the time to the effect of marsh miasma on blood cells. His search led him to the living parasites. So at last, the demons and noxious vapors, the assorted metaphysical and physiological dyscrasia that had beclouded the etiology of malaria were discarded and man moved a giant stride closer to his goal.

Then, in 1897-1898, came the fourth fundamental observation. Ronald Ross in India found the parasite of human malaria undergoing development in the gut of an Anopheles mosquito and then he demonstrated a complete chain of transmission of avian malaria from bird to Culex mosquito to bird. Italian scientists, Bastianelli, Bignami and Grassi filled in the important gap by proving the chain of transmission of human malaria, from man to Anopheles mosquito to man. Thus, as the 20th Century began, the way seemed clear for the eradication of malaria. The focus for attack was gradually sharpened from an entire genus to certain species of anophelines and tremendous victories were won in Cuba, the Panama Canal Zone, Ismailia, Malaya, and elsewhere. But although the reduction in malaria incidence was often great, the disease was seldom eradicated except where climate gave fundamental assistance. Drainage too often permitted vector breeding in ditches, quinine never did more than lower mortality and morbidity, larviciding often left sufficient vector density to maintain malaria transmission. Fifty years after Ross and the Italians had incriminated the mosquito, the tropics and subtropics remained highly malarious. In fact, malaria control was not economically possible in the rural tropics generally.

The latent power of malaria was also revealed in such episodes as the European pandemic after World War I, Ceylon's fulminant epidemic of 1934-35, the appalling case rates in Allied and Japanese armies prior to mid-1943 in World War II, and the high morbidity rates in Italy and Greece as recently as 1945. Our antimalaria tools were good but not good enough.

Finally, came the fifth discovery, made in 1939 in Switzerland by Paul Müller. He discovered the remarkable insecticidal properties of DDT. This Nobel Prize winning observation paved the way for the present era of malaria eradication. By a happy coincidence some of the newer synthetic antimalarials appeared about the same time so that we are now powerfully equipped for what we confidently believe will be the final drive against malaria.

Residual Insecticides

THREE synthetic residual insecticides are now in general use in malaria eradication projects throughout the world, viz. DDT, BHC, and dieldrin. Technical DDT contains several isomers of which the para-para prime is the most effective. DDT is nonvolatile. To kill a mosquito, DDT must adhere to and be dissolved in the waxy covering of the feet, and then be transferred to and penetrate through the cuticle. DDT sometimes irritates mosquitoes so that they may fly away from a treated surface before absorbing a lethal dose. However, continued absorption from crystals clinging to the feet of the insect usually results in its death. DDT is still widely used in malaria eradication projects.

BHC is the abbreviated name of the insecticide known as benzene hexachloride. Technical BHC consists of several isomers of which the gamma is the most effective against mosquitoes. This isomer is often sold as lindane. The gamma BHC, unlike DDT, is relatively volatile and it poisons by vapor effect as well as by contact. It does not normally irritate the insects and therefore a

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fatal dose is usually acquired by the insect during normal resting time. In many areas, BHC has been found more suitable than DDT.

The third commonly used insecticide is dieldrin. Like DDT it is nonvolatile, killing by contact only. It produces a high anopheline mortality under most conditions. Dieldrin is somewhat more toxic to warm-blooded animals and to man than are DDT or BHC but is in widespread use with excellent results.

Theory of Malaria Control

MACDONALD (1957) has for some years been studying the mathematical basis of the complicated phenomena involved in the epidemiology of malaria. He makes it clear that malaria, through its man to mosquito to man chain of transmission, has a basic reproduction rate which is the number of secondary infections originating from a single primary case. Its value varies from place to place and time to time. This reproduction rate is dependent on such factors as density, man-biting habits and longevity of the mosquito, length of the developmental period of the plasmodium in the insect, and length of the normal period of infectivity in nonimmune humans. Obviously, if the basic reproduction rate falls below one, successive generations of malaria cases will be smaller and smaller and malaria will tend to disappear. On the contrary, if the rate exceeds one, the incidence of malaria will rise.

However susceptible to malaria a community of Anopheles mosquitoes may be, the insects can not maintain malaria transmission in a given area unless they have sufficient density to support a malaria reproduction rate of one or more. Naturally, the more avidly the anophelines take human blood and the longer the span of life during which they feed, the smaller will be the number of them required to maintain malaria transmission. So, for any combination of man-biting habit and anopheline longevity there is a critical density of the insect vector below which malaria transmission is not maintained. An anopheline vector such as Madras culicifacies, which has a relatively short life and which has a 90% preference for animal blood, must be present in great numbers to maintain malaria transmission. By contrast, African gambiae in many areas has a relatively long life which is largely devoted to the taking of human blood. Thus smaller numbers maintain transmission. In fact, a critical vector density of 0.01 in West Africa maintains intensely endemic malaria which a critical density of 30.0 for culicifacies in Madras is not able to equal.

Antilarval drainage and larviciding tend to control adult density because this adult density is usually directly proportional to the density of the larvae. But the influence of larva control is indirect and often relatively weak. If the critical density required for malaria transmission is high, an attack on larvae has a chance of bringing adult density below the decisive figure. But if the critical density is low a nearly perfect control of larvae may be required to stop malaria transmission. This is rarely feasible or even possible to obtain.

Undoubtedly, a direct attack on the adult is more logical in malaria control. This effects the malaria reproduction rate in several ways: it decreases the density of the adults; it lessens the probability that infected insects will live long enough to become infective; it shortens the life expectancy and thus the period during which transmission can be accomplished. Because of the attack on the adults there may also be a decrease in egg-laying sufficient to lower larva density, sometimes even to the point of extinction of a species in a given area.

Principles of Malaria Eradication

MOST authorities agree that eradiction is preferable to conventional control measures because it sets a definite end point, because it is cheaper in the long run, and because the growing phenomenon of Anopheles tolerance to residual insecticides indicates that the choice is either eradicating malaria or indefinitely enduring a disease transmitted by increasing numbers of resistant vectors.

Current malaria eradication programs have four phases: preparatory, attack, consolidation, and maintenance (WHO, 1957). The preparatory phase includes initial survey, planning, and preliminary operations. It may last from several months to a year. The phase of attack begins as soon as the preparatory phase ends and continues with total spraying coverage until malaria transmission has eased and the parasite reservoir has been nearly emptied. It has generally been found that most falciparum and vivax infections will have died out in two and a half to three years if there has been no reinfection. So three years is usually the minimum duration of an attack phase. A few foci of residual malaria will often remain at the end of an attack phase.

The phase of consolidation begins as the widespread spraying attack on the insect ends. During consolidation, residual pockets of transmission must be found and eradicated and the parasites remaining in man eliminated. Case-finding and the use of antimalaria drugs have first importance. For this aspect of malaria eradication a new concept has arisen, that of surveillance. It is defined as that part of a malaria eradication project which is concerned with the discovery, the cure, and the prevention of such residual malaria infections in man as would delay the ending of transmission or threaten

its resumption in a given area. Surveillance may be started in the attack phase but is most active in the phase of consolidation. This essential and rather difficult phase of consolidation ends when during three years of active surveillance no locally contracted infections have occurred. Because malaria mortality and morbidity are so low during this key phase of an eradication project, it is sometimes difficult to obtain the necessary financial support from either governmental or international sources to carry the work through to completion. It is an important paradox in some areas that when malaria incidence becomes very low, more money and attention than ever should be put into malaria eradication.

The final phase of maintenance begins when malaria has been eradicated from an area and it lasts as long as malaria exists anywhere in the world. But maintenance is not difficult or expensive because it is carried out by regular health departments which add malaria to the list of exotic diseases against which they are always on guard.

In most large countries, time schedules will vary in different areas, some of the latter coming to the maintenance phase sooner than others.

Problems

IN addition to such anticipated problems as that of residual pockets of malaria transmission remaining after three or more years of spraying, several unexpected difficulties have arisen in the world-wide drive to eradicate malaria. One of the major problems today is that of the resistance of anophelines to residual insecticides.

Resistance to Insecticides

THE PROBLEM of Anopheles resistance to residual insecticides is of great interest to malariologists today. Among the 50 or more species that are significant vectors of malaria, physiologic resistance has been detected and confirmed, since 1951, in some part of the geographic range of six, viz., Anopheles, gambiae, quadrimaculatus, sacharovi, stephensi, subpictus, and sundaicus. In one area, Greece, such resistance has clearly delayed a malaria eradication project.

This resistance problem is still not clearly understood but considerable progress has been made in the study of certain aspects. To begin with, what we believe to be a normal anopheline mosquito will not habitually avoid contact with residual insecticides; if it does, it is said to have behavioristic resistance, as has been reported in A. albimanus in Panama. Moreover, a so-called normal anopheline will absorb through its cuticle DDT, BHC, or dieldrin; will not detoxify or excrete unchanged these insecticides or store them as inactive deposits in tissue; and does not have nerve axons or myoneural mechanisms that are unaffected by the toxicants. In other words, the normal anopheline is susceptible to the residual insecticides and is killed by them because of damage to its nervous system. If an insect does not absorb the insecticide, or if it can block or neutralize the usual lethal effects of such absorption it is said to exhibit physiologic resistance.

On the basis of studies by Macdonald (1957) and colleagues (Davidson, 1957), it is apparent that physiologic resistance is hereditarily transmitted from parent Anopheles to offspring and that this inheritance follows the pattern associated with a single pair of genes, described as monofactorial. It also appears that this specific physiologic resistance divides into at least two classes: in the first, there is group resistance to BHC and dieldrin and their close relatives; in the second, the group resistance is to DDT and closely related compounds. Within each group, resistance to one insecticide is accompanied by resistance to the others. But resistance within one group of chemicals does not imply resistance to compounds of the other group. Thus, DDT is effective against dieldrin-resistant A. gambiae in Northern Nigeria, and dieldrin works well against DDT-resistant A. sundaicus in Northern Java.

Techniques are being developed to make it possible to determine on a practical scale in the field, in advance of a spraying program, what sort of physiologic resistance is present in a given species of a given area and, more than this, to find out the proportions of wholly resistant, hybrid, and wholly susceptible anophelines. As Macdonald (1957) points out, "The occurrence of resistance, the discovery that it is possible to detect the gene even when present in very small numbers, and the fact that the technique of detection is relatively simple, indicate a definite line of field activity which should be incorporated in all survey work."

The problem of Anopheles resistance to insecticides is a real one although so far such resistance has not delayed the world-wide program seriously. But each year brings new reports of such resistance in hitherto unaffected areas. Obviously, more basic research is required to solve this annoying problem.

Progress of Malaria Eradication

ABOUT 45% of the world's total population of 2.68 billions live in communities in which they are now or have very recently been exposed to malaria infection. That is to say, world-wide malaria eradication requires the prevention of mosquito-borne malaria infections among a total exposed population of 1.2 billions, among whom, as mentioned earlier, there were probably some 200 million cases of malaria in 1957. Expressed

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in another way, 138 of the world's total of 196 nations, territories, dependencies, or administered areas listed in the 1956 UN Demographic Yearbook, require malaria eradication programs, 58 being nonmalarious. Obviously, when to the numerical immensity of the task are added the geographical, social, financial and, especially, administrative aspects, the world-wide project has truly colossal size.

That significant progress has already been made may be inferred from the fact that by the end of 1957, officially adopted nation-wide malaria eradication schemes were in preparatory, operative, or maintenance phases in 76 countries having a total exposed population of some 728 millions, or about 61% of all who must eventually be included (not counting population changes). We may say, in the words of Churchill, that we are "at the end of the beginning but not yet at the beginning of the end."

International Cooperation

ONE OF THE most heartening aspects of the campaign to eradicate malaria from the world is its genuine international character. It seems to me that in all the long history of mankind there has never been a world-wide cooperative effort equal to it in size or sincerity.

Great credit should go to the World Health Organization (WHO) for its effective leadership in the amazing acceleration of malaria eradication since 1947. The Malaria Section, with the help of five WHO Regional Offices, has stimulated nation-wide projects, demonstrated the feasibility of residual spraying in many areas, provided fellowships and training courses, organized regional malaria conferences, fostered intercountry and interregional unanimity, and financed basic research.

The Pan American Sanitary Organization (PASO) which also functions as the Regional Office of WHO for the Americas, has had a key role in the attack on malaria in the New World. It is now coordinating and pushing the very active hemisphere-wide project that will drive malaria completely out of North and South America and the West Indies.

Another organization that has had a tremendous impact on malaria is the United Nations Children's Fund (UNICEF). From 1947 to 1957, inclusive, this agency spent no less than $26.4 million in no fewer than 56 countries and territories to combat malaria (Pate, 1958). The 1958 UNICEF malaria budget is approximately $8 millions. Here have been the sinews of war without which WHO, which has given technical direction to the spending of UNICEF malaria monies, would have been seriously handicapped. The gains of the past few years would have been impossible without this basic UNICEF support.

The United States has also had a vital part in global malaria eradication, in addition to carrying out a successful campaign within its own borders and in Puerto Rico. This country, in the first place, contributes a relatively large share of the budgets of WHO, UNICEF, and PASO, a share that has totalled over $11 million annually. Secondly, through the International Cooperation Administration (ICA) and its predecessor "Point Four" agencies, the United States has spent a total of $88.9 million since 1942 to combat malaria in more than 30 countries.

In 1957, the International Development Advisory Board (IDAB), created by Congress in 1950 to advise the President on foreign economic aid policy, recommended that the United States support a five-year malaria eradication program among nations of the free world, at a total cost of $519 million, of which the United States would contribute a fifth, international agencies another fifth, and national governments three-fifths. This recommendation has been implemented for the first year by the provision of a 1958 budget of $23.3 million to ICA. From this, the United States has presented $5 million to WHO for its Malaria Eradication Special Account and $2 million to a similar account in PASO.

It must be emphasized that a great deal of money is being appropriated by national governments for malaria eradication. They provide about 60% of the total costs. Much credit is due the political leaders in the countries that have budgeted relatively large sums in order to purge their borders of the malaria burden. One example is that of El Salvador which has an eradication project that will likely be completed in 1959. The total cost is estimated at $3.4 million of which the country itself has budgeted $2.7 million. Inasmuch as El Salvador has been losing an estimated $12.4 million a year as a result of malaria, the investment in eradication is obviously a sound one.

Conclusions

TEN YEARS ago the concept of nation-wide malaria eradication was little more than a dream and the slogan "world-wide eradication" seemed fantastic to most observers. Today, the evidence is convincing that within the next ten years, malaria can be eradicated from many countries, and from wide areas of many others. World-wide eradication is a feasible goal that could be attained, it seems to me, by 1985. Undoubtedly, the difficulties and the financial requirements are enormous but the available resources of money and technological skills that could logically be invested in this project are vastly greater than the needs and would return a handsome profit.

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We are all disturbed by world conditions and, as Bertrand Russell has said, the important question to most of us is not whether man can inhabit other planets but can he continue to live on this one. Every day it becomes clearer that the foundations for peace, for our very existence as a nation, require much more than military hardware stored at home or sent abroad. Our nation has been wise indeed to give financial and technical aid so generously to other countries. For example, a great deal of strength has been gained, I believe, from our overseas programs of assistance in public health, unspectacular though they have been. Here is a sphere of human endeavor in which an inspiring amount of unselfish international cooperation has occurred, particularly in malaria eradication projects. Moreover, these activities have come close to the hearts of masses of people. I hope that the United States will increase its financial and technical support to overseas public health development and particularly to world-wide malaria eradication. More funds, more basic research, and more trained personnel are required. The dividend rate on dollars invested in this way, I dare say, will be higher than that from any other type of investment designed to safeguard the free world.

In spite of all his science and in spite of all his education and knowledge, man has been for centuries and in many areas still is stumbling over an insect. But at last we have a unique opportunity to stop mosquito transmission of malaria completely. Let us hope that we shall not fail to utilize this golden moment.

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The Increasing Cost of Blue Cross-Blue Shield Coverage

THE INCREASES in the cost of hospitalization and doctor care are inexorable and unyielding. Because of this there must inevitably be increases in the cost of Blue Cross and Blue Shield. The trend is nation-wide, and is causing concern among all policy holders. These rising costs as well as the desire for more complete medical expense coverage have prompted labor unions to consider Union sponsored insurance plans. Any wide spread move of this sort on the part of labor would seriously weaken Blue Cross and Blue Shield. Much of the misunderstanding which now exists could certainly be helped by free discussion between the leaders of labor and medicine on local levels. This will be done in Westchester County in the near future. Competition from private insurance companies in the health insurance field is also weakening Blue Cross and Blue Shield. In many cases this is due to lower rates charged by these companies. These low rates are possible because several factors such as cancellable policies, age restrictions, and careful selection of their clients. Consequently, Blue Cross and Blue Shield are being left with an increasingly higher proportion of poorer risks. In addition doctors themselves are weakening the plans by their willingness to hospitalize or treat patients in hospitals unnecessarily. A rotating committee of staff physicians in hospitals could supervise the violations that do occur and advise the offending physician of his duty to organized medicine. Since it is evident now that the public demands prepaid health insurance in some form physicians must solve their health insurance problems or face the alternative of government supervised insurance.

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The Automobile Seat Belt a Factor in Preventive Surgery

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DURING the past decade the number of people injured in automobile accidents has been increasing unchecked, and has been recently estimated at more than one million annually. The group of severe injuries in this annual tragedy involves an alarming number of persons. Excessive speed has been incriminated in the vast majority of accidents in which severe or multiple injuries have been sustained. The mortality has increased at such a distressing rate that virtually the entire country apprehensively awaits the bad news at the end of each holiday.

Because of the ever increasing number of automobiles on the roads, and the constantly increasing horsepower and speed of these cars, it became apparent that something would have to be done to increase driver and passenger safety in the event of collision.

Recently, a group of physicians headed by Paul Braunstein, from the Cornell University Medical College, presented in the journal *Surgery, Gynecology and Obstetrics* the results of an extensive study on injuries sustained in collision accidents, and a means for their prevention.[1] The Cornell group began their crash research in 1942 with light airplanes.[2] They later turned their attention to safety factors in the operation of motor vehicles. The present study consists of an analysis of 1000 injury producing accidents in which 1678 occupants were injured. Of this group, it was found that 75% had some form of head injury. About one-half of all occupants are injured to a minor degree only, and 39% received injury of moderate through fatal degree. Head and lower extremity injuries were observed most frequently in combination multiple injuries. They note that multiple injuries constituted the most common pattern in the group.

One of the most important findings of a previous study was that ejection of passengers or driver from the vehicle more than doubles the chance of multiple severe injuries. Also, mortality mounts precipitously when combination severe injuries occur, particularly of the head, major fractures of the extremities and internal injuries. It is, therefore, of considerable importance to be aware that when a car overturns there is a 73% chance of ejection if there are no seat belts or other safety measures.[3]

A study was then made of 300 accidents in which the cars were equipped with seat belts. By reviewing over 4000 control cases they were able to match 81 cars without seat belts with 81 cars with seat belts. This control group was identical in all respects to the type of accident, make, model, year and weight of the cars. The figures are startling and of great significance. "Some injury was experienced by 75.5% of persons in the control group (no belts) and 29.9% of the experimental group (with belts). Moderate through fatal degree injury was reported from 23% of the control group versus 9.2% of the experimental group." It was their conclusion that seat belts, as studied in 162 cases of automobile accidents, seem dramatically to lessen the severity and frequency of injuries.

Some concern has been expressed about the possibility of abdominal injury due to the seat belt itself in the event of an accident. Although there have been some cases of soft tissue injury and occasionally damage to the spleen, these usually occur in severe accidents in which the individual might well have sustained lethal injuries had not seat belts been worn. A few cracked ribs or even removal of a spleen is a small price to pay for a life.

Recently an accident occurred involving several executives of one of the country's largest industrial concerns. Several of these men had a prolonged and painful hospital experience before they were able to return to their work

The foregoing study indicates that had the company sedans been equipped with seat belts these men would probably have escaped with nothing more than a few lacerations and bruises, and would have been able to return to their families and their work in a matter of hours instead of the weeks of confinement required.

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Vosburgh[4] recently reviewed the accidental deaths of one large company for 1957. Two thirds of all accidental deaths resulted from automobile accidents, in which the average age of the victims was 35 years. It is his opinion that the use of seat belts on company automobiles, coupled with an effective educational program, would result in the saving of 22 lives each year in this company alone! Considering the number of large industrial concerns in this country, a little simple multiplication increases this figure to eyebrow-raising proportions. Aside from the factor of preventive surgery, the reduction of mortality as well as the reduction of lost time in each company would represent a significant sum of preventive expense, not to mention preventive grief.

Some large industrial concerns throughout the country have frequently assumed a major role participating in preventive medicine. This was recently exemplified by polio programs, and immunization of personnel against Asian "flu." It would seem that these same companies could also participate in a program of "preventive surgery" by having all company-owned cars equipped with seat belts, and establishing an active campaign to bring this type of information to the attention of their employees. If such a program were carried through, it is possible that the continued upward spiral of yearly injuries could be slowed or halted. Certainly, the use of the various propaganda media have not produced any significant effect on the accident rate. One way toward the solution would be active participation, on the part of both the companies and employees, in the use of seat belts.

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The Health Team Views Social Medicine

THE FACT that man and his environment combine to form the patient was a recognized basic principle in ancient medical practice. The era of modern medical practice was predicated on the equal importance of prevention and cure. Certainly these are no "new concepts" to the health team who for untold years have recognized the well-being of man is highly complex in nature. "Social Medicine" as a specialty needing special courses in the medical curriculum is viewed by the health team with suspicion and mixed feelings. They fear the predominance of the lay personnel and institutions that work within the field of Social Security and are the promoters of Social Medicine. These endanger the professional activities of the team as a team. The increasing incidence of mental disturbance that results from society's intrusion into the life of the individual seems to rest upon a foundation in which the mental and physical status of the individual is being increasingly influenced by and dependent upon his environment, especially his society. One advocate of the philosophy of Social Medicine claims that current medical activity must accept that man's concept of himself is based on the postulate that he "is in charge of the terrestrial destiny of his own species and that he enjoys a very large measure of freedom in choosing what he will make of himself and of the society which he has developed." This and similar phrases in a sense embody democratic principles, and illustrate the technique and the procedure certain groups adopt in promoting programs intended to throttle free enterprise. It is the responsibility of the health team to expose the distorted plagiaristic basis, fraudulent aims and socialistic intent of the "new concepts" that is being developed in the expanded program to bring the health professions under the domination of incompetent sociopolitical leadership. The only "new" concept that the members of the health team should find in Social Medicine is another scheme by which the unity and the freedom of the health professions can be undermined by inculcating each student with acceptance of the underlying principles of Social Security. The "disease" in this instance is recognized, and only a preventive program will control it effectively. —From *World Medical Association News Letter*, May, 1958.

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The Differential Diagnosis of Dizziness

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THE PURPOSE of this paper is an attempt to understand the problem of dizziness. Since dizziness is a symptom of dysfunction of the sense of equilibrium, let us review the mechanism concerned with balance.

The master sense organ controlling motion is the labyrinth. This little organ is buried deep within the temporal bone. It is the only tissue in the body that has reached its full size and development at birth. Whereas man has changed many of his habits and characteristics, nature has not found it necessary to modify the structure of the inner ear. We think of the pituitary as the "master gland." Secure though it is anatomically in the middle of the skull, the labyrinth is even more protected by compact bone immediately surrounding the vital membranous structures and is additionally protected by the ramparts of the surrounding pneumatic bone of the mastoid and petrous pyramids of the temporal bone.

In higher vertebrates the sense of equilibrium in the labyrinth is shared with the special sense of hearing. The cochlear mechanism is concerned with hearing, and the vestibular part of the labyrinth is concerned with equilibrium. This close association of static and kinetic sense with the hearing mechanism has an important clinical feature in the diagnosis of the cause of dizziness which will be described in later paragraphs.

We may define vertigo as a sensation in which the senses are deceived into seeing or feeling movement. The patient is likely to refer to this hallucination of movement as a giddiness, lightheadedness, tailspin or post-in-hole sensation. Cawthorne states, "There is no need to postulate a turning or whirling movement." Vertigo is always accompanied by a disturbance of balance which usually causes the sufferer to seek support, and if sudden and severe, may throw him to the ground.

Vertigo may occur at rest or even awaken the patient, causing him to clutch at the chair or bedclothes for added support. The overwhelming giddiness, distressing nausea and excessive eye movement, all enhanced by the slightest movement of the head, present a picture of helpless misery that has few parallels in the whole field of injury or disease.

What produces dizziness? The relative frequency of the causes of vertigo and the location of the lesion is demonstrated by the following figures from Cawthorne's series of 1523 cases.[1] The relative frequency of causes of vertigo and location of the lesion in Cawthorne's series of 1523 were as follows (Table I):

TABLE I

Central		107
Peripheral		1349
Hydrops (Meniere's Disease)	972	
Trauma	123	
Vestibular neuronitis	109	
Positional	84	
Infective	61	
Not classified		67
Total		1523

IN ADDITION to a careful detailed history and physical examination, special tests must be made in all cases presenting dizziness as a major complaint. Postural tests are not generally used although these tests will often make the diagnosis and demonstrate objective evidence of the patient's subjective complaint of dizziness. We conduct the postural tests according to the method of Cawthorne. The patient is seated upon the examination table. He is instructed that he will be placed in various positions and that it is imperative that he keep his eyes open at all times. Frenzel glasses are used, and the patient is instructed to look directly forward. Spontaneous nystagmus is noted if present. If absent, the patient's head is held by the examiner and the patient is placed in the supine position with the head to one side (the side indicated as the offending position if given in the history). A latency period of 10 seconds is permitted for the recognition of the positional nystagmus. If the nystagmus does not occur after 10 seconds, the patient is brought upright and again the examiner looks for nystagmus. If absent after 10 seconds, the patient is placed in the supine position to the opposite side of the first procedure. If nystagmus is not observed the patient is returned to the sitting position and again examined for the presence or absence of nystagmus. In the absence of nystagmus the patient is

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placed in the supine position with the head lower than the shoulders (midline, head-hanging position). If nystagmus is absent after 10 seconds the patient is returned to the upright position and again examined for nystagmus.

If nystagmus occurs, the intensity, direction or nature, the duration and presence or absence of vomiting are noted on the record. If nystagmus is noted in one or more of the positions, that position is held until it subsides. If the nystagmus persists for more than 30 seconds it will probably continue as long as the critical position is maintained. Should nystagmus persist for 30 seconds the patient is returned to the upright position, and after a short pause is placed in the same position which provoked the nystagmus. If the nystagmus does not reappear it is recorded as readily fatigable. If the nystagmus reappears with diminished intensity, and on further attempts does not occur at all, it is recorded as gradually fatigable, and if the nystagmus continues with undiminished intensity despite repetition it is recorded as nonfatigable.

After the postural tests have been made the physician should test the patient for past-pointing, adiadokokinesis, Rhomberg and other signs of disturbance of equilibrium and coordination. Finally, tests of cochlear (hearing) and vestibular function (cold and warm caloric tests) should be made.

CENTRAL lesions may be differentiated from peripheral lesions by the characteristic of nystagmus according to the following outline:

Type I Positional Nystagmus irregular in direction or changes direction with alteration of position. Found only in diseases involving the central vestibular pathways.

1. Disseminated Sclerosis: Sclerotic plaques scattered throughout the brain and spinal cord, characteristically affect certain cranial nerves, especially the 2nd and the 8th. Intention tremor, scanning speech, optic disk changes, paretic gold curve, negative Kahn.

2. Epilepsy: Aura, loss of consciousness with cry, fall, convulsion, tonic or clonic; dizziness, consisting of a feeling of rotation or bodily displacement.

3. Acoustic Neuroma: Onset gradual with increasing loss of unilateral hearing, vertigo slight. + Rhomberg, falling to side of lesion, nystagmus to affected side, caloric test absent on affected side. X-ray shows enlargement of the internal acoustic meatus.

4. Tumors, Cerebrum (Supratentorial): Persistent sense of dysequilibrium, choking of disks of optic nerve, failing vision. Vertical and/or spontaneous nystagmus — sustained. Sensory disturbances.

5. Tumors, Cerebellum Brainstem (Infratentorial): Disturbance of equillibrium and coordination (adiadokokinesis, past-pointing, positive Rhomberg). Nystagmus may be spontaneous, fine and continuous. If postural, nystagmus will recur each time the provocative position is assumed and continue as long as the patient remains in offending position. Caloric tests show decreased sensitivity. Ataxic gait with continuous sense of unsteadiness (in midline cerebellar disease).

6. Vascular: Largest group of patients complaining of dizziness, probably due to interference with blood supply to brain: hemorrhage, thrombosis, embolism, vasomotor insufficiency, hypertension, hypotension, climacteric, drugs and intoxications: Alcohol, tobacco, Streptomycin, quinine, salicylates, lead, barbiturates, anesthesia. Vertigo is influenced by position — nystagmus may persist as long as the position is maintained. (a) Post cerebellar artery thrombosis. (b) Meningovascular syphilis. (c) Arteriosclerosis. (d) Periarteritis nodosa. (e) Thromboangiitis obliterans. (f) Thrombocytopenic purpura. (g) Leukemia. (h) Pernicious anemia. (i) Polycythemia vera. (j) Virus Infections: mumps, measles, scarlet fever, typhoid, typhus, gout, Ramsay-Hunt.

7. Encephalitis: Dizziness associated with unsteady gait, diplopia, dysphagia, drooling of saliva. Occasional facial paralysis — stuporous — no single lesion to explain multiple symptoms.

8. Psychosomatic Anxiety, Stress: Vertigo, postural — positional nystagmus — no tinnitus, loss of hearing, or evidence of central nervous system disease.

Dizziness is a symptom in diseases of the peripheral organ. Localizing signs of tinnitus and hearing impairment are commonly present.

PERIPHERAL lesions may be classified as follows:

Type II Positional Nystagmus — constant direction, not changed by position. May be found in diseases of either central or peripheral system.

1. Labyrinthine Hydrops (Meniere's Disease): No sign of central nervous system disease, tinnitus, sudden onset of vertigo — relief after rest and between attacks — unilateral hearing loss and recruitment (10%). Postural tests positive. Caloric test reduced.

2. Trauma (Fracture - concussion): History of injury — longitudinal or transverse fracture shows blood in middle ear, occasionally spinal fluid — conduction loss until absorption of blood and fluids. Hearing improves — three weeks. In labyrinthine concussion high tone loss similar to 4,096 dip observed in acoustic trauma. Vertigo of postural nature with positional nystagmus — objective proof of subjective complaint of dizziness. Tinnitus may subside in three weeks or may persist.

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3. Infections: (a) Otitis media — catarrhal — direct effect on round window. (b) Otitis media — suppurative — may lead to fistula. Positive fistula test — infection spreading from middle ear to the labyrinth and intracranial area may provoke dizziness secondary to the inflammatory process set up by the primary infection in the middle ear, mastoid, labyrinth and petrous pyramid, i.e., labyrinthitis, meningitis, temporal lobe abscess.

4. Vestibular Neuronitis: No hearing loss or tinnitus. Vertigo like "topheavy or off balance," postural character, reduced caloric and galvanic response, blood count and sedimentation rate will suggest presence of infection. Course of vertigo benign, usually subsides in a few weeks.

5. Paroxysmal Positional Vertigo: Most important feature is the "readily fatigable" character of the postural vertigo. The nystagmus comes on after a latency period of only a few seconds, the amplitude is large, and the subjective vertigo is so severe that the patient will frequently cry out and grasp for support. The episode passes quickly and usually cannot be reproduced except after a period of at least 30 minutes rest. The caloric tests show a varying degree of canal paresis.

6. Other: Total obstruction of canal by foreign body. Cerumen impaction; barometric changes — sudden change in middle ear pressures may produce dizziness. History and examination make diagnosis. Transient dizziness may be associated with auricular fibrillation, decompensated cardiac disease, aortic stenosis and carotid sinus sensitivity. The dizziness probably is secondary to the abnormal impulses spreading from the vestibular nuclei in the brainstem to the adjacent vagal centers set off by a change in blood supply.

Central and peripheral lesions may further be differentiated into the characteristics of cases belonging to the peripheral and central groups (Table II):

TABLE II

	Peripheral Group	Central Group
Direction of Nystagmus	Constant in different head positions	May vary with different head positions
Onset of nystagmus after assuming new posture	Latency period of 3—10 seconds	Immediate onset
Amplitude of Nystagmus	Usually large	Usually small
Duration of Nystagmus	3—10 seconds	Much longer, may continue indefinitely as long as provocative posture is maintained.
Fatigability of response to repetition of postural change	Nystagmus cannot be elicited more than one, two or three times in diminishing intensity	Nystagmus recurs each time provocative posture is assumed.
Sensation of vertigo	Severe	Mild
Associated nausea	Common	Rare

Summary

THE PHYSICIAN, when attending the patient whose presenting complaint is distressing dizziness, will be served by a painstaking history as supplied by the patient. The usual patient is eager to describe his symptoms in great detail, particularly if the physician has gained the confidence of the patient. This history may prove particularly significant to the final diagnosis. An equally detailed physical examination will lead to the demonstration of objective signs that either negate or support the patient's statements. Ordinarily it becomes possible to reach precise conclusions in those patients whose chief complaint is that of dizziness.

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Freedom to Think

THERE is a more important freedom than any of those mentioned in Mr. Roosevelt's famous four. It is the freedom to think. What good is freedom of speech without freedom to think? In this, science is the freest way of life I know of. It is free to think. It can entertain new ideas and concepts as no other way of life can. The politician must ask what the effect of a new concept will be on his party and on his political fortunes. The chauvinist must ask what the effect will be on his nation or race. The sectarian must ask whether the concept is truly orthodox, whether it falls within the tenets of his sect. The scientist asks only if it is true or if it shows promise as a working hypothesis.

—From "Scientfic Freedom," by S. S. GILL, in *J.A.M.A.*, April 5, 1958.

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Hazards of Diving With Self-Contained Underwater Breathing Apparatus

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THE INDUSTRIAL physician now must add at least a rule-of-thumb knowledge of diving medicine to his lists of talents. Since the development of barometric compensated demand valves for increased pressures, the practice of diving with self-contained equipment has spread all over the world, but nowhere has it caught the public fancy as in the United States. Diving is no longer only a sport of the tropical seashore. The diving equipment has been proved useful for many kinds of underwater work, not the least of which is geological searching. Sport divers' clubs are everywhere. The absence of a nearby body of water does not deter them. They hold their meetings and training sessions at the local pool in preparation for their outdoor season when they join up for trips to sizeable bodies of water. The ski trains of winter sportsmen are complemented by the diving cruises into areas of warm waters. The "mechanic magazines" contain numerous advertisements suggesting that the nov ice may build his own diving equipment — if not from salvaged parts discarded from military equipment, then from something special made by the advertizer.

If for no other reason than that the company recreation association may be sponsoring an aquatic sports club, the industrial physician has a need to know. The life he may save may even be his own for many physicians have found this an intriguing way to knit the "raveled sleeve of care." The layman who knows he does not understand it all is likely to be more safe than his professional fellow sportsman who knows not that he knows not.

We must first of all distinguish between the skin diver — who is just that, a swimmer who dives — and the diver. It matters not that the skin diver wears foot fins to aid his swimming, goggles or face mask (preferably the latter) to give him better underwater vision or uses a snorkel (breathing tube). He is a swimmer and can stay submerged only so long as he can hold his breath. He is subject chiefly to the hazards of swimming. Some enthusiasts extend their breath-holding by excessive effort and expose themselves to the toxic effects of carbon dioxide accumulation. The profession generally believes that one cannot hold their breath long enough to do any harm, but this is not the fact. There is at least one recorded instance of a mental patient committing suicide by holding his breath before an unbelieving audience of doctors, nurses and medical attendants.[1] A few years ago a fad spread across the country among teen-agers of testing each other's breath holding endurance. The result frequently was loss of consciousness in what they called "red out," in contrast to the aviator's "black out" of anoxia. There is evidence both pro and con that sensitivity to elevated carbon dioxide levels is associated with the "shallow water black out" of divers.[2,3]

Before investing money in any diving outfit the individual should consider the matter of physical fitness to dive. Diving is not a form of hydrotherapy in the usual sense of that term. It is hard work — much more strenuous than walking. While the surface swimmer is able to adjust the energy expended to a comfortable level, this is not true for the diver. Underwater even the exertion of breathing is considerable. This is due to the resistance of the valves and the air ways, and the increased density of the air. In addition, there is the exertion of swimming. No hard and fast rule can be laid down, but it seems reasonable that a person with active disease of the pulmonary or cardiovascular systems should not engage in any strenuous sport, including this one. Air travelers know they may encounter difficulty in equalizing pressure in the ears and sinuses with changes in altitude. These same individuals often do not realize that the relative pressure differential produced by altitude changes of hundreds of feet may be produced by

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a foot or two difference in underwater depth. Certainly those who do not have the ability to equalize pressure in their ears and sinuses would do well to find another sport. Chronic ear infections are not likely to improve. Perforated ear drums invite infection with possible disastrous results on hearing ability. Aside from the liability of flare-ups of infection, there is the more immediate danger of extreme dizziness caused by water entering the ear and producing the reaction of the caloric test of vestibular function. The dizziness is bad enough, but when accompanied by nausea, it may produce an underwater situation ending fatally. Although hard and fast rules cannot be prescribed, common sense dictates what is and is not appropriate fitness to dive. (See reference 4 for more detailed discussion.)

In addition to the considerations of physical fitness, there is the matter of self-confidence in the water. This is more than being a good swimmer although that is highly desirable. The underwater world is fascinating but it is, for man, an unnatural and hostile environment. Emergencies and surprises can and do arise frequently in this sport. Life or death hangs in the balance for the moment. Nothing else means so much in that instant as calm deliberate evaluation of the situation based on self-confidence. This composure is not gained hastily nor by chance. Sport diving is not for those who are novices at water sports nor for the physically soft or unsound.

The sportsman diver uses some form of self-contained underwater breathing apparatus (abbreviated to "scuba" for convenience) which supplies him with a breathing medium from a compressed supply carried in a flask. This is an appropriate place to condemn any misguided and dangerous attempt to use underwater a rescue breathing or smoke type apparatus having a demand valve. The demand valves of this type of equipment simply are not expected to operate adequately under the increased ambient pressures encountered in diving; not even at relatively shallow depths. This is the chief objection to the use of demand valves salvaged from aviator's oxygen equipment. Do not use anything but equipment designed for this purpose and backed by the good name of a reputable manufacturer.

Another basic rule of diving safety is, never use oxygen as a breathing medium. About a year ago a letter was received from a physician in the Middle West asking what chemical was used in a diving outfit to absorb carbon dioxide. Being aware that physicians often make mistakes because of being partly informed, this inquiry aroused the suspicion that this doctor was making an oxygen, closed-circuit type scuba in the belief that a small flask of oxygen could be used safely to extend his submerged time. There is such equipment used by experts for special military missions. Their use can be reasonably safe in the hands of especially indoctrinated experienced divers but they are never used by choice, only out of necessity. They clearly are not for the sportsman diver.

A cautious answer was composed for the doctor. It was suggested that a canister design for diving equipment is not the same as for gas masks, that moisture can ruin the effectiveness of the carbon dioxide absorbent, that failure of the absorbent can result in "shallow water blackout" (presumably carbon dioxide toxicity) and unconsciousness leading to drowning. And, if none of these happened, he could always worry about oxygen convulsions. The Navy tests candidates for diver school by having them breathe oxygen from a mask for 30 minutes while at a pressure equivalent to being 60 feet deep in the water. An appreciable number fail this test. Astonishingly few physicians seem to have heard of this convulsant effect of oxygen. This rule is worth repeating — never use an oxygen outfit.

Now we have the confident swimmer equipped with a well designed, open circuit, air-supplied self-contained underwater breathing apparatus. We specify the open circuit type because this eliminates the carbon dioxide absorbent canister required in closed circuits and removes the hazard of failure of this unit. This equipment is not cheap. It deserves good care and maintenance. Since the user's life depends on its proper function who should be more interested in knowing how to take care of it?

The diver should learn to service and maintain his own equipment. The proper care of such equipment can be learned in part by reading the literature supplied with the equipment. However, nothing written in sales promotion pamphlets equals the lessons that can be imparted by one who has learned by an experience he has survived. For this reason the novice sport diver should join an organized diving club. There are clubs of all kinds. This unique sport attracts many types who desire to do something different. It would be wise to affiliate with a club associated with an organization known to have a sound, conservative water sport program rather than with a collection of "aquatic hot-rodders." Although not an infallible test, those clubs having grown past adolescence in this sport recognize that the setting of diving records is a temptation to foolhardiness. Novices should avoid such groups for their own safety and the sake of the sport's good reputation. A good club will sponsor activities for divers at various levels of proficiency. Since this is something new, as it was to all the others at some time, there should be no reluctance in lining up with the beginners. Training programs must be adjusted to the time, place

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and facilities available. But sometime in the course of any good training program there are certain things that will be heard over and over. Among them are:

Don't dive alone — Underwater emergencies can arise when least expected from failure of equipment, from illness of the diver, from underwater hazards — living things or mechanical things. One diving buddy can look out for the other.

Use a buddy-line — Whenever diving at night or in conditions of poor visibility, a diver can find his buddy if they are tied to each other. Commander Douglas Fane, the daring leader of underwater demolition teams wrote on a casualty report, "Another life saved by the buddy system." This endorsement should be testimony enough for anyone.

Don't try to set records — The world's deepest diver was last seen going down. The object is to come back, not to see how deep one can go.

Easy does it — After all it is a sport. Exhaustion is the door to disaster. A tired man does not think well. All people do not swim equally well nor have the same endurance. A less able swimmer can exhaust himself trying to keep up with a more able buddy and once exhausted he is easy prey in an emergency. He may not only lose his own life but also may cause his buddy to lose his in rescue efforts. Take turns at being the leader so each diver frequently has a chance to set the pace.

Never forget to exhale when coming up — This fundamental rule has to do with Boyle's Law of the behavior of gases. At constant temperature, the volume of a given mass of gas varies inversely as the absolute pressure exerted on it. A diver 33 feet deep in the water (two atmospheres absolute pressure) whose chest is filled with air would, if he held his breath, have two chest fulls when he reached the surface (one atmosphere absolute). Obviously his ribs keep his lungs from expanding to double their size so the pressure is not equal inside the lungs and outside the body. This pressure gradient is exerted across the alveolar membrane. A pressure gradient such as this can force air out of the alveoli, into the interstitial tissues (emphysema) and even into the vascular tree (air embolism). Fatal air embolism has been known to occur from quite shallow depths (10-15 feet). Critical experiments on animals have established that a gradient of 60-70 mm Hg. across the pulmonary tissue is sufficient to cause this kind of trauma.[5] While emphysema may be only bothersome and distressing, air embolism is an immediate critical emergency. The only adequate treatment when air embolism causes unconsciousness is recompression to a depth sufficient for treatment (165 feet). Unfortunately facilities for recompression are expensive and require knowledgeable operators. Very few civilian owned recompression facilities exist. The Navy has such facilities distributed along the sea coasts to meet its needs.

Sport divers who do not set out to establish records are not ordinarily liable to encounter problems of decompression sickness unless they dive deep, stay down for long periods or, what is more often the mistake, make several dives in a day. The sport is so fascinating it creates a strong temptation to go deeper and stay longer. The manufacturers of the better known equipment have tried to avoid this problem by controlling the size of the compressed air flask. However, popular demand has created a market for outfits with more than one flask. There is only one way to avoid this problem and that is to never exceed the no decompression schedule shown in Table I. One dive a day made within these limits is relatively safe.

TABLE I.
NO DECOMPRESSION DIVE SCHEDULES*

Deepest Depth of Dive in feet	"Bottom Time"** in minutes
35	310
40	200
50	100
60	60
70	50
80	40
90	30
100	25
110	20
120	15
130	10
140	10
150	5
160	5

*This schedule, based on experimental data collected by the U. S. Navy Experimental Diving Unit, Washington, D.C., will appear in a revision of the Navy Diving Manual now in preparation. It is based on a rate of ascent of 60 feet per minute.

**"Bottom time" commences when the diver leaves the surface and ends when he leaves the bottom to ascend directly to the surface.

It is not appropriate to attempt a short course in diving medicine in such an article as this. Those who desire a wider range of clinical discussion should consult the article by Doctor Edward Lanphier.[4] Those who find themselves in the position of adviser or consultant to a diving club or who simply wish to know more about the subject should obtain a copy of *Submarine Medicine Practice* (NAVMED-P-5054) from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. ($2.00 a copy). This document is the text for the correspondence course in Submarine and Diving Medicine for Naval Reserve medical officers. While meaty with fact, it is free of the often misleading romance of many of the commercial ventures in this field of writing. For those who are involved in diving operations the revision of the Navy

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Diving Manual, now in preparation, will be of great interest. It contains the latest revision of the decompression tables for air diving and also a set of decompression tables for more than one dive in a day (repetitive dives), published there for the first time. The Diving Manual will be found most helpful for the industrial physician who needs to study up on safe diving practices — an area sadly neglected by many civilian divers. Since any diving casualty of consequence is potentially a fatal case or a lifetime disability matter, it behooves industry to pay attention to and insist on adherence to safe practices. The Diving Manual is expected to be available on public sale from the Superintendent of Documents in the Fall of 1958.

A sprightly phrased but thoroughly sound document in this field is *The Science of Skin and Scuba Diving* prepared by the Conference for National Cooperation in Aquatics.[6] The authors are experienced divers who have compiled an interesting, scientifically accurate document aimed at the layman. They have drawn on their large experience in the laboratory and in the field to promote safe practices in this area of endeavor. This book will be useful as a guide to novices in this field and provides lively reading for the physician.

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Chemical Carcinogens

ALMOST as old as the experimental study of cancer is the question whether the process of carcinogenesis should not be regarded as a special case of biological mutation — whether every mutagen is a carcinogen, and every carcinogen a mutagen, as was raised by Strong (1949). Whatever the relationship of the carcinogenic and mutagenic mechanisms, there is no doubt that each can shed light on the other. From a cytogenetical analysis of the action of carcinogens in Drosophila melanogaster, with special reference to 1:2-3:4-diepoxybutane, Bird & Fahmy (1953) first suggested modification in gene pattern of such a kind as to prevent normal reproduction, the disabled gene reproducing itself either partially or erroneously, or not at all. The general biological evidence has for some considerable time pointed to the possibility that the cancer cell represents a somatic mutation by loss, and recent work would appear to support this — although by no means as yet conclusively — and to suggest that the deficiency is genetical or enzymic in nature. Certainly it is entirely feasible that the loss of enzyme systems normally concerned in controlling the synthesis of substances essential to cell division could result in the unregulated synthesis or accumulation of such substances, and so convert the normal cell from a state of nutritional dependence to one of self-sufficiency and unimpeded growth. The principle proposed is by no means novel. Reference has already been made to the suggestion of the Millers that combination of an azo carcinogen and an autosynthetic protein could result in the gradual removal of this protein from the cell and its descendants, an autonomous tumour thus arising from a permanent alteration or loss of proteins essential for the control of growth. Potter (1950) also believed there are certain enzymes of strategic importance in limiting the growth of normal cells, the loss of which may mark the conversion from normal to malignant.

—From "Chemical Carcinogens," by ALEXANDER HADDOW in *British Medical Bulletin*, May, 1958.

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Prevention and Control of Staphylococcus Infections in Hospitals

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IT IS CLEAR that throughout the world, in spite of the enormous success of antibiotics (and, as will be mentioned below, to some extent because of this success) there remains an important problem of infections, a problem of special significance for hospitals. This report is concerned with such infections, particularly those caused by the coagulase-producing strains of staphylococcus aureus hemolyticus. The most obvious examples are impetigo and more severe infections in children, puerperal mastitis in recently delivered women, burn and postoperative wound infections, and pneumonia in debilitated patients. The staphylococcus may also be responsible for osteomyelitis, meningitis, septicemias, empyemas, boils and abscesses, otitis media, paronychiae, etc.

Disease-producing staphylococci frequently implant in the nasopharynx without overt disease, thus producing carriers. Indeed, the staphylococcus carrier-rate is a good index of the level of contamination of the environment.

Many hospitals have a serious problem with staphylococcus infections, and all hospitals have a potential problem. Information is inadequate as to the incidence of staphylococcus infections which are acquired in hospitals, but there is evidence that the number of such infections is increasing.

There appear to be innumerable strains of staphylococcus capable of producing infections. Many of these staphylococci are susceptible to antibiotics. Some are not. Infections with antibiotic-resistant staphylococci constitute the main difficulty. Hospitals are clearly the reservoir of most antibiotic-resistant strains. Strains from the community at large are predominantly sensitive to antibiotics. The strains carried by patients on admission are less frequently resistant than strains which are acquired in hospitals. Patients who acquire these infections in the hospital are potential spreaders of resistant strains to the community after discharge. One of the major factors in the current situation is the widespread use of antibiotics which eliminates susceptible strains of staphylococcus and leaves uncontrolled the resistant strains.

It is not known whether resistant strains of this organism actually acquire resistance after exposure to the antibiotics, or are resistant to begin with and are simply unmasked by the suppression of susceptible strains — although the latter is thought to be the case. From a practical point of view it does not matter which theory is correct.

Certain factors frequently found in hospitalization appear to make patients more likely to acquire such staphylococcus infections: routine indiscriminate use of antibiotics, especially for "prophylaxis;" long hospital stay; contact, direct and indirect, with infected hospital patients, staff members or personnel; crowding and inadequacy of facilities; prolonged operative procedures; prolonged use of continuous parenteral therapy through venipunctures or indwelling plastic tubing.

Certain factors in the host (patient) appear to increase susceptibility to infection: treatment with adrenocortical steroids; physical debility; chronic disease; prematurity; diabetes; bed sores; open wounds or breaks in the skin; chronic pulmonary disease.

The danger of infection seems to be especially great from direct exposure to people who are infected with the staphylococcus, although exposure to the same organisms alone, in or on contaminated equipment, supplies, dressings, air, dust, wall or floor surfaces, linens, etc., may be equally as important and dangerous. The physician, nurse or other attendant who has a boil, paronychia, abscess, or nasopharyngeal infection with a virulent strain is particularly hazardous.

From American Hospital Association Bulletin 1, prepared by the Council on Professional Practice's Committee on Infections Within Hospitals consisting of: Dean A. Clark, M.D., chairman; William A. Altemeier, M.D.; C. P. Cardwell Jr.,; James P. Dixon Jr., M.D.; Maxwell Finland, M.D.; Horace L. Hodes, M.D.; Martha Johnson, R.N.; and Alexander D. Langmuir, M.D., in consultation with Kenneth B. Babcock, M.D., of the Joint Commission on Accreditation of Hospitals; William H. Stewart, M.D., of the Public Health Service; and others.

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Recommendations

ALL HOSPITALS should establish Committees on Infections, to devote particular attention to infections which are acquired in hospitals so they may be reduced to the lowest possible minimum. The Joint Commission on Accreditation of Hospitals is being asked to consider the establishment of a Committee on Infections as a major factor in the accreditation of a hospital.

It is suggested that the Committee on Infections include, where possible, a bacteriologist, a pediatrician, a surgeon, an internist, a nurse and a hospital administrator. The local health officer should be urged to serve as a consultant to the committee. The committee should report periodically to the executive committee of the medical staff. The functions of the Committee on Infections should include at least the following:

1. To establish a system of reporting infections among patients and personnel, such a system being essential to a proper understanding of infections which are acquired in hospitals. The committee should have acceess to all reports of infections anywhere in the hospital.

2. To keep records of infections as a basis for the study of their sources and for recommendations regarding remedial measures.

3. To distinguish to the best of its ability between infections acquired in the hospital and those acquired outside.

4. To review the hospital's bateriological services to make sure that such services are of high quality and are accessible either in the hospital itself or in an outside laboratory. Bacteriophage typing, if not available in the hospital, may be sought, as needed, through official local and state health agencies.

5. To review aseptic techniques employed in operating rooms, delivery rooms, nurseries, and in the treatment of all patients with infections and, if indicated, to recommend methods to improve these techniques and their enforcement.

6. To make vigorous efforts to reduce to the minimum consistent with adequate patient care: Use of antibiotics, especially as "prophylaxis" in clean, elective surgery; treatment with adrenocortical steroids.

7. To undertake an educational program to convince medical staff and hospital employees of the importance of reporting to responsible authorities when they have skin infections, boils, acute upper respiratory infections, and the like.

8. To establish techniques for discovering infections which do not become manifest until after discharge from the hospital, it being known that such infections are often overlooked because they may not be apparent until several weeks after the patient has left the hospital. Two approaches to discovering such infections are suggested:

An attempt to trace the source of any infection with which a patient may be admitted. For example, if an infant is admitted with staphylococcal pneumonia or a recently delivered mother with mastitis, the hospital where delivery occurred should be determined and informed of the infection so that it can seek possible source of infection.

Periodic telephone polls on a random sample of discharged patients (particularly recently delivered mothers, newborns, and postoperative patients) to ascertain their state of health and, in case of any indication of infection, to follow them up. Such surveys have proved quite simple and quite valuable. A detailed account of the method is given by Ravenholt and others in the October 1956 issue of the *American Journal of Public Health*.

Hospital administration should undertake the following measures to assist in the control of infections:

1. Diligent maintenance of the general cleanliness of *all* areas in the hospital, not simply in those associated with operating rooms, delivery rooms, and nurseries. Other possible sources, such as dust, air pollution (special attention should be given to ventilating and air-conditioning systems and their filters), and floors must also be considered as potentially important factors in the spread of infection. There should be regular inspections of the hospital for general cleanliness.

2. Special studies among staff and personnel to uncover silent carriers of staphylococcus, especially in epidemic situations accompanied by repeated cases traceable to the same organism.

3. Appropriate measures for the treatment of all carriers who persistently show heavy growth of epidemic strains of staphylococcus in nasopharyngeal cultures or who are identified by epidemiological evidence.

4. Transfer of such carriers and personnel with skin infections, boils, acute upper respiratory infections, and the like from locations such as operating rooms, delivery rooms, food-handling positions, and nurseries to other duty stations in the hospital. Usually such transfers have proved to be sufficient to control the problem, but occasionally leave of absence for a persistent carrier has been necessary.

Hospitals should initiate or participate in community programs to control infection through cooperation with other hospitals, local medical societies, local health departments, and other groups.

Comment

OCCASIONALLY, an entire hospital, a whole community, or a large area seems to become subject to an epidemic strain of staphylococcus. Why this occurs is not known. However it points

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up the need for more general recognition and study of staphylococcus infections.

Among the agencies from which consultation and assistance concerning infection problems may be sought are the following: (a) The American Hospital Association, the American College of Surgeons, and the American Academy of Pediatrics (especially for newborn infants) which will furnish upon request the names of suitable consultants. (b) Local and state health departments which, in many instances, have experts on their staffs. (c) The Communicable Disease Center of the U.S. Public Health Service, Atlanta, Georgia, whose assistance may be obtained through local and state health departments.

Valuable background information and discussion about the infection problem can be found in: (a) Conference on staphylococcal infections. (Symposium) *Journal of the American Medical Association.* 166: 1177-1203, March 8, 1958; (Editorial p. 1205). (b) Observations relative to the nature and control of epidemic staphylococcal disease. F. H. Wentworth and others. *American Journal of Public Health.* 48: 287-98, March 1958. (c) New York (State) Department of Health Guide for the prevention and control of infections in hospitals. Albany; 56p. illust. 1957. (d) New York Academy of Science. Staphylococcal infections: a symposium. The New York Academy, 1956. 57-246 p. illust., tables. (Annals of the New York Academy of Sciences, 65: 57-246). (e) The problem of postoperative wound infection and its significance. W. A. Altemeier. Annals of Surgery. 147:770 1958.

Role of the Family Physician

IT IS PERHAPS not surprising that 81 percent of the American people — or about four out of five — report that they have a family physician to whom they turn regularly when they are sick. What might seem more remarkable in this era of dramatic medical progress and of rising demand for more and ever-better care is the public's recognition that the focal point of medical care has not shifted. Clearly the point of first contact in time of illness and emergency remains generally unchanged. The personal character of the relationship between patient and family physician has not given way to impersonal arrangements for physician services in which the patient does not have the prevailing range of choice. As Dr. Paul Hawley, director of the American College of Surgeons, has said: "Every family needs a medical adviser upon which it can rely, whether or not such a need is recognized. The family physician is the only practitioner of medicine who can fill this role properly. He should be more than an adviser. He should be the medical manager; and, if he has earned the full confidence of the family, he will occupy such a position." Apparently the typical family physician has earned that kind of confidence and is considered a medical manager. Patient cooperation in following medical advice is assured in such a climate of approval — where patients exercise free choice of family physician and where the physician, despite a frequently heavy workload, responds intimately to the need for his services. It is unfortunate that the supply of family physicians in rural areas is generally considered inadequate, as interviews with physicians and laymen indicate. Not enough physicians choose to practice in sparsely populated areas. Those who do, on the other hand, are relatively young; this is encouraging because family doctors tend to stay for many years, if not a lifetime, in the same areas. It is also encouraging that family physicians — somewhat contrary to prevalent assumptions — have achieved more staff appointments to community hospitals in recent years. Also, as this study shows, they often guide patients in the selection of specialists for the more serious and complex illnesses. Both are trends in keeping with the manifold nature of modern medical science. Good medical care will always depend on how early during illness a physician is consulted and how readily his advice is accepted by those who ask for it. The public has unerringly perceived these basic facts. Otherwise people would not ask, as they do, that a family physician be the first called to home or hospital in time of stress or whenever advice is needed for the maintenance of good health. —GEORGE BUGBEE, President, Health Information Foundation.

XUM

Recognition and Control of Radiant Heat

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THE human body is equipped to compensate for a wide range of environmental conditions. However, the compensating ability is limited and if the limit is exceeded there is a possibility of health damage.

Let us briefly review this compensating mechanism. Basically, it is a means of body heat loss by radiation, convection and evaporative cooling owing to the evaporation of perspiration. When external heat stress reaches a level beyond the limits of these heat regulators, body temperature will rise, with the possibility of heat strain. By heat strain we mean any adverse reaction caused by heat exposure.

When we control toxic materials in the industrial environment we usually have a maximum allowable concentration to guide us in our opinion of whether the toxic materials might result in health damage. Unfortunately, the maximum limit for heat exposure has not been clearly defined in terms of readily measured environmental factors. The problem is quite complex. Air temperature, radiation, humidity, air speed, skin temperature, body heat production and clothing are among the factors which must be considered in determining the environmental stress. Sweating capacity, tolerance to elevated body temperatures, and duration of exposure are among the factors which will determine the resultant heat strain.

What determines a comfortable environment? What is the nature of the heat problem? Why don't local exhausts and fans improve the condition? What is the source of the heat and what can be done about it?

The four basic factors which determine the comfort of an environment, whether we feel too hot or too cold, are air temperature, the temperature of surrounding objects, relative humidity and air motion. In this discussion we will be concerned with air temperature and temperature of the surrounding objects.

Heat generated in an industrial operation can be transferred by convection, by conduction or by radiation.

Heat transfer by radiation is fundamentally different from either convection or conduction. However, it follows well known elementary physical laws. Many of us have applied them to radiant heat control, but it is only in recent years that they have been applied to the industrial environment.

If we feel uncomfortably warm, we usually think first of reducing the temperature. Our next consideration might be to remove the heat by ventilation or to reduce it by supplying cool air. If our problem is due to convected heat, these control methods will be effective. However, in hot industrial operations such as handling and pouring molten metal, forgings, heat treating and sealing and annealing glass, as much as two-thirds of the total heat load can result from radiant heat. The most elaborate and expensive ventilating and air supply systems will not control radiant heat.

Radiant heat with which we are concerned is chiefly infrared energy. In the electromagnetic spectrum, these energy rays have wavelengths greater than 7600 Angstroms.

In its physical nature radiant heat follows the laws of light. It travels in a straight line from its source, needs no medium of transfer, has no effect on the air through which it passes and is not affected by air movement in the surrounding area. We can blow it away no more than we can blow the light away by directing a fan at it.

Molten metal, hot castings and forgings, furnaces and heated glass are among the sources of infrared energy in the industrial plant. Employees and unprotected objects in the vicinities of these sources are the receivers.

Infrared rays that reach a receiver are either transmitted, reflected or absorbed depending upon the material from which the receiver is constructed. If transmitted or reflected, they have little or no effect. If absorbed, the temperature of the receiver will rise.

The majority of building materials such as brick, wood, concrete and steel are good absorbers of radiant heat. Unfortunately, the unprotected human body is also an excellent absorbing me-

dium. We demonstrate our ability to absorb radiant energy when we expose ourselves to the sun. We also demonstrate the marked difference in heat load that can be placed on the body by radiant energy when we seek a shady spot on a sunny summer day. With air temperature around 90°, the shade of a tree is much more comfortable than direct rays of the sun, although the air temperature in the shade is still 90°.

Attempts to measure the heat load on an employee with an ordinary thermometer result in considerable error when a radiant heat source is present. The thermometer will register air temperature plus only a small fraction of the radiant heat. The result, therefore, does not give a reliable measure of the heat load. Under these conditions the thermometer must be shielded from radiant heat to give an accurate air temperature.

Radiant temperatures are measured with a globe, or black bulb thermometer. This instrument is merely a hollow metal sphere with a thermometer sealed into the inside air space. The sphere has a dull, black finish to minimize reflection of the radiant heat rays. When exposed to a source of radiant heat, the energy is absorbed by the sphere. The increase in temperature is transmitted to the air within the sphere where it can be measured by the thermometer.

We have modified the globe thermometer by sealing a thermocouple inside the globe with leads to a potentiometer. For survey purposes the globes can be hung at the desired points without the attached potentiometer and the instrument attached when readings are taken.

The accuracy of data obtained with the globe thermometer may be open to criticism. It is not used as a precise scientific instrument. It simulates an employee and gives us an indication of his average heat load, since it absorbs heat energy on the side facing the source and loses heat by convection and reradiation in all directions away from the source.

We recognize an intense radiant heat source by our own sensory perception. In surveys of heat exposure, however, both air temperature and globe temperature readings are taken. A globe temperature higher than air temperature indicates a radiant heat source.

When the globe temperature is higher, it is a better index of heat than air temperature. If we find a globe temperature of 120° and an air temperature of 85° at the same location, we should consider the heat load on the employee as 120°.

What can we do about a radiant heat problem? We can protect employees or equipment by shielding them from the source. In some instances shielding can be combined with ventilation or air cooling. However, with or without supplemental control measures shielding is of primary importance. Shields can be designed for heat exchange, absorption or reflection.

Reflective shields have proved the simplest and most effective. The effectiveness depends upon the material from which they are constructed. Some materials are good reflectors of visible light and poor reflectors of infrared. Others are poor reflectors of visible light and efficient for infrared.

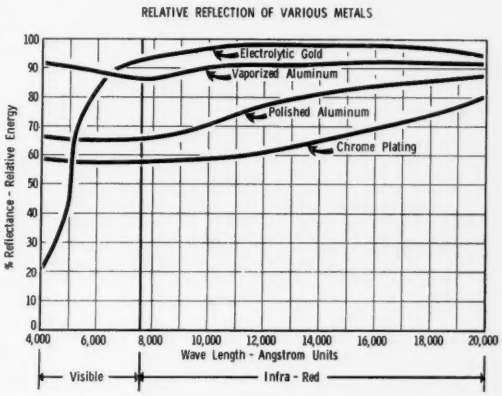

Fig. 1.

The relative reflection of various metals is shown by the curves in Fig. 1. The curves are drawn from data on reflectors designed for industrial infrared heat lamps. The graph shows percent reflectance along the vertical axis at the indicated wave lengths plotted on the horizontal axis.

From the gold curve we note that gold is not a good reflector for visible light, but has excellent reflective qualities in the infrared. Vaporized aluminium gives good reflectance through the visible and infrared. Polished aluminum is of medium quality in the visible spectrum and increases in reflectance efficiency in the higher infrared wave lengths. A chrome plated surface, which we might consider a good reflector because of its mirror finish, is relatively poor in reflecting both visible and infrared.

Based on effectiveness alone, gold would be our first choice. Obviously economy demands a compromise. Since vaporized aluminum surfaces are not practical in the large sizes usually required compromise leads us to the polished aluminum which has good infrared reflectance, is readily available, is comparatively moderate in cost and will retain its reflectance characteristics in most installations with relatively little maintenance.

The effectiveness has no relation to the thick-

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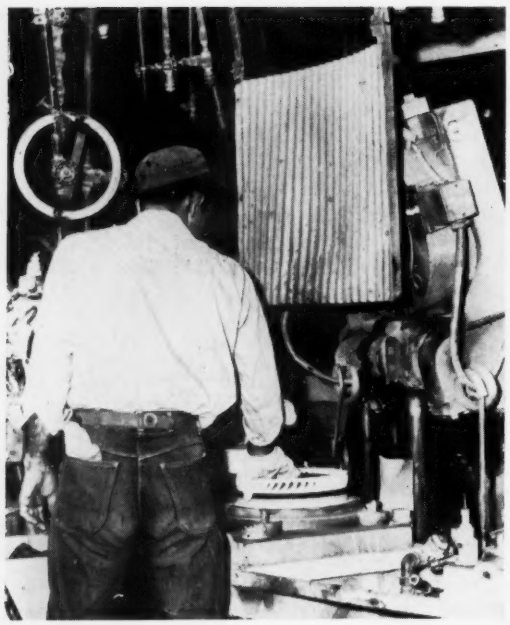

Fig. 2.

ness of the aluminum. Ordinary kitchen wrapping foil will reflect radiant heat as well as one-quarter inch aluminum sheets.

So far this is all basic information. What can we do with it? Let's look at a few illustrations to see how this can be applied to an industrial plant.

A corrugated aluminum enclosure was placed around a pot of molten metal in an aluminum foundry. There is a permanent opening for the pouring ladle and the whole rear side is hinged double doors which can be opened for loading or servicing the pot. This enclosure has been so satisfactory that all plans for new installation or relocation of equipment in this plant now include provision for radiant heat shields.

Fig. 2 shows a turntable molding machine in an aluminum foundry. The upper half of the hot die is opposite the employee's face as the table stops for him to position the core assembly. The small piece of corrugated aluminum protects the employee's face from the radiant heat emitted by the die. The shield is hinged for quick removal if access to the die becomes necessary.

Fig. 3 shows a surface combination furnace after shielding on all four sides with corrugated aluminum in angle iron frames. Each section is a separate panel held to the adjoining panel and frame by readily removable clamps. The shields are set at 10° from the perpendicular to reflect the radiant heat upward. Gravity vents in the roof allow escape of convected heat. The result — installing shields reduced the radiant temperature at the feed station from over 160° to 113°, a reduction of more than 47°. It is more significant when we consider that this operation continued during summer weather when it was too hot for other operations in the same shop. Before installing the shields, shut downs because of excessive heat were experienced as early as February.

A portable shield may be used in many places. It is merely an angle iron frame supporting the corrugated aluminum. It stands free and can be readily moved out of the way for servicing equipment. They are particularly useful at locations where shields cannot be permanently mounted.

Fig. 4 shows hinged shields at the pouring line of a grey iron foundry. The hinged mountings facilitate cleaning the under sides. Cleaning is necessary to maintain the effectiveness.

Fig. 5 shows a closeup of the pouring operation. Although the entire flask is not covered by the shield, it is apparent that the upper part of the employee's body is protected. Work is

Fig. 3.

being done on the design of a shield to protect the employee from the heat radiated by the ladle. As yet, none of the designs have been entirely satisfactory. Local exhaust, of course, controls smoke and convected heat.

Fig. 6 gives data on shielding effect on radiant temperature resulting from an extensive radiant heat control program. Installation of shields was done systematically, usually one machine at

a time, and presented an opportunity to correlate radiant temperatures before and after shielding at reasonably constant air temperatures.

Radiant temperatures at three operations before and after shielding are shown. The amount of reduction tells the story quite clearly. There was as much as 40° reduction in radiant temperature. The figures marked with an asterisk are of special interest. By reducing radiant temperature to air temperature, radiant heat was no longer a problem.

The shade of a goose-neck desk lamp, similar to the auxiliary lighting fixtures commonly used on machines, is lined with aluminum kitchen foil to reduce the surface temperature and prevent burns from accidental contact. We know that about 80% of the electrical energy consumed by an incandescent light bulb is expended as infrared energy.

Using a 100 watt incandescent bulb in this lamp, the apex of the shade had a surface temperature of 200° F. before the shade was lined. The aluminum lining reduced the surface temperature to 105° F. This is a very simple application of radiant heat reflection that may significantly reduce a common hazard to your machine operators.

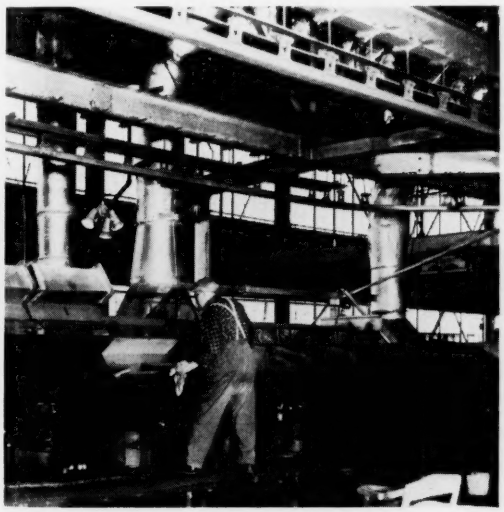

Fig. 4.

These are a few illustrations of the application of radiant heat control principles to the industrial environment. One of our major problems has been to convince management and plant engineers that control of radiant heat is fundamentally different from the control of convected heat. We have developed a simple demonstration of the effectiveness of various materials as heat shields. Although very elementary, and subject to some variations, it does help illustrate the basic principles.

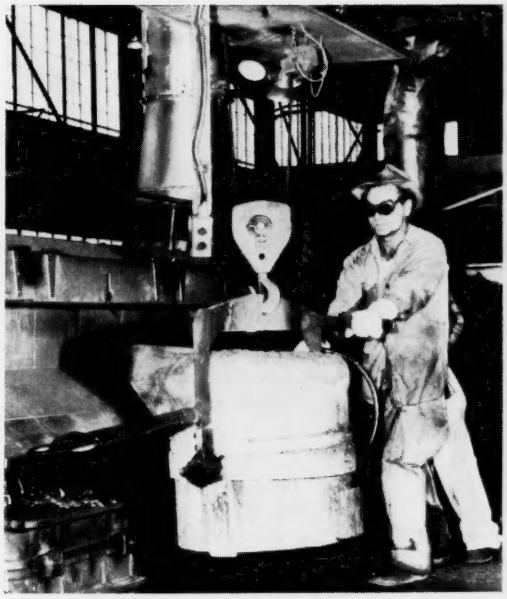

Fig. 5.

In the center of a turntable, a 600 watt cone-shaped radiant heater is placed (Fig. 7). The vertical uprights are shields of various materials. The black, horn-shaped instrument is a radiation thermopile. It has a series of thermocouple junctions at the back of the horn. The EMF of the thermopile is amplified by an electronic circuit and registered on a meter.

The scale is marked from left to right in tenths. The right hand limit of 1.0 is equivalent to 100% and is used as the starting point when the thermopile is exposed directly to the heating coil. Any reduction of the full heat load is in-

SHIELDING EFFECT ON RADIANT TEMPERATURE

	Before	After	Reduction
OPERATION A			
Face Level	109°	85°	24°
Waist Level	98°	87°	11°
OPERATION B			
Operator 1 - Face Level	109°	*82°	27°
Waist Level	89°	*82°	7°
Operator 2 - Face Level	102°	*82°	20°
Waist Level	98°	*82°	16°
OPERATION C			
Face Level	130°	90°	40°
Waist Level	110°	86°	24°

* Equal to air temperature.

Fig. 6.

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dicated by movement of the needle toward the left. The amount of reduction will be relative, and expressed in percentage of the full heat load as indicated on the scale.

This is not a precise temperature indicating instrument and there are some fluctuations in the needle due to uncontrolled influences on the thermopile. The heater has been on long enough for all parts to reach maximum temperature gain.

Since the results are relative, we'll start with the thermopile exposed directly to the full heat energy of the radiant heater and set the meter at 100%.

A shield should reduce the heat load. Using a black steel shield, the reduction in radiant heat is only about 10%. The black steel shield is a good radiator.

We know that white surfaces are usually good reflectors for visible light. If we use a steel shield painted white instead of black we gain a little more, probably about 2%. This is insignificant

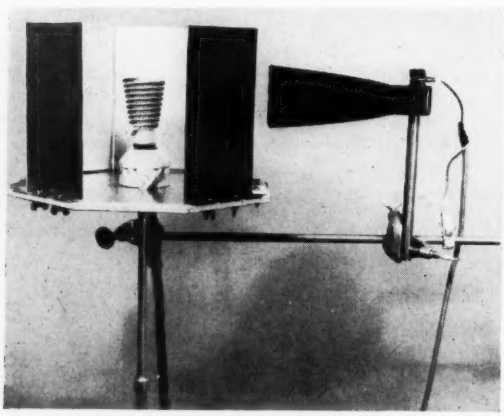

Fig. 7.

and not worth the maintenance required to keep it white.

We have seen illustrations of aluminum shields. What about using aluminum paint on a steel shield? The reduction, about 50%, is a significant improvement.

Asbestos is a time-honored material for protection against heat. If we use it as a shield against radiant heat, the reduction is only about 15%.

Returning to full heat load on the thermopile, we adjust it again to 100% and use an aluminum shield. A reduction of about 90% is quite a dramatic improvement.

What will happen if the aluminum shield gets dirty? To illustrate this, an aluminum shield was dusted with ground forging scale. The effectiveness has been greatly reduced. The clean shield reflected about 90% of the radiant heat and the

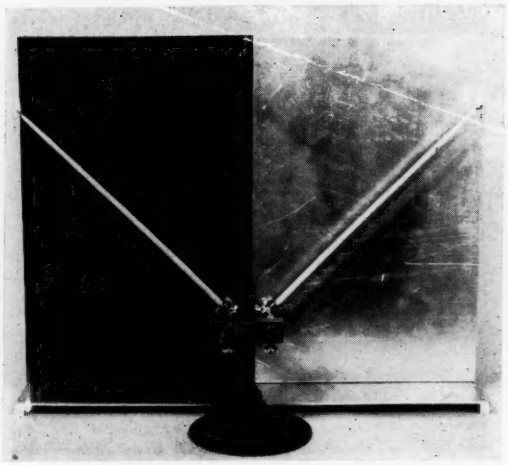

Fig. 8.

dirty shield reflected only about 20%. This does not mean that shields must be kept buffed to a mirror finish, but it does indicate that some maintenance is necessary to preserve the reflective quality.

Aluminized steel is a comparatively new product in sheet metal work. It may have advantages over plain steel and plain aluminum for certain applications. If we apply it as a radiant heat shield, we see that it can reduce the radiant heat load about 80%. It is not as good as plain aluminum, but a reduction of 80% is quite significant.

Two heat shields, one of 1/16 inch aluminum and the other of 1/16 inch steel, painted flat black are prepared (Fig. 8). A 1000 watt radiant heater behind the shields has been on long enough to bring the shields to their maximum temperature gain.

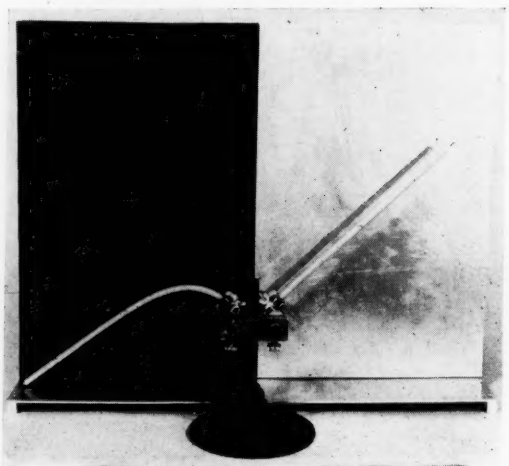

Fig. 9.

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The two candles are ordinary dripless wax, the type used for dinner table decoration. The candles are placed so that one is in front of the black steel shield and one in front of the aluminum shield.

After five minutes the candle in front of the black shield seems to be in a bad way (Fig. 9). The heat radiated by the black shield has softened the wax while the aluminum shield has protected the other candle.

Use of steel for heat shields is quite a common practice. They eventually turn black in the industrial environment and become good radiators. Here we have a direct, side by side comparison of the difference between black steel and aluminum. Fortunately the human body can adjust itself to heat loads better than these slim, wax candles.

Suppose the human body were as susceptible to heat as these candles and you were given your choice of either the black shield or the aluminum shield at your work station. Would you choose the aluminum shield to end your day erect and robust or the black shield and end your day limp and drooping?

Summary

THE EFFICIENT detection and control of radiant heat is possible by the utilization of the methods and procedures outlined in this manuscript.

Zoonoses

MAN realized centuries ago, that epizooties continuously threaten to exterminate those animals, both wild and domestic, on which he is dependent. Later he learned that these epizootics at times endanger his own life. Today it is fully appreciated that animals expose rural people to certain infections that drain their vitality and make their labors less profitable, but discussions of rural health practice rarely consider this. It is timely, therefore, to analyze the available knowledge of the most important of these infections and the methods of control that public health and zootechnical authorities may adopt to improve rural health, welfare, and economy. The word "zoonosis," originally chosen by Virchow, is applied to infections of animals that are secondarily contagious to man. Certain epizootic or enzootic infections of domesticated animals are particularly hazardous to country dwellers. The care, the breeding, frequently the butchering or the consumption of flesh of diseased or invisibly infected animals offer unlimited opportunities for exchange of the infective agents. Bacteria, fungi, protozoa, viruses, and helminths may invade the human body by any of several routes — through the mouth, the skin, the mucous membranes, or the respiratory tract. Direct contact with infected animals or animal products and consumption of animal products contaminated during processing and delivery are the most common modes of transmission of the zoonoses. Bacterial, viral, and protozoan parasites conveyed by contact with wild animals or by vectors in forests and fields adjacent to human dwellings are equally hazardous. The farmer may acquire the infection without ever having had direct contact with the infected animal host. The reservoirs of infection in the lower animals now dominate the problems of zoonoses in their relation to human welfare. Infective agents may be totally inconspicuous in their natural animal host; in fact, the infections they cause are most frequently chronic, latent, and subclinical. Without a comprehensive understanding of the ecology of the mammals, birds, and arthropods — infected and infectable — it is impossible to be fully aware of the complexity of these infection chains. It is important to understand that biologic and ecologic factors, known and unknown, are constantly affecting both host and parasite. A high incidence of infected arthropod vectors (for example, plague-infected fleas or encephalitis-virus-carrying mosquitos) does not necessarily initiate epidemics among the people of regions heavily seeded with reservoirs of infection. Without comprehensive knowledge and understanding of the infective agent, its vector if any, and its reservoirs (usual and accidental) and their interrelationship, it is impossible to gauge the potentiality of the reservoirs and to decide on the proper scale of preventive and suppressive measures to be taken. Today the real problem of suppressing or eradicating zoonoses is much less a problem of wiping out overt disease than of learning the usual habitats of infective agents and then of dealing with what are often ineradicable mammalian, bird, or arthropod reservoirs.

—From "The Zoonoses in Their Relation to Rural Health," by KARL F. MEYER, in *WHO*, 1954.

XUM

The Expansion of Fringe Benefits and Industrial Dentistry

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THE GENERAL trend in fringe benefits soon may be reflected in expanding requirements for dental services. Clauses providing for various kinds of dental treatment are being included in union contracts, workmen's compensation legislation and industrial insurance policies.

Medical and dental clinics under union supervision are now accepted establishments under the "fringe" benefit provisions covering welfare funds in the majority of current labor-industrial contracts. The fact is, these clinics are here to stay.

Supervision by Management

MANAGEMENT must take the position, therefore, that since it is required to pay for medical and dental services, it has the right to provide for them directly. These services should be offered within the plant area if possible, or else close by.

A dentist who is familiar with the requirements of industrial dentistry should be retained. His office should be in, or as close as possible to the industrial plant in order to permit managerial regulation of the dental service for reasons of increased efficiency, minimal cost and the general operational advantages of big business.

Service in Compensable Injury Cases

ECONOMY TO EMPLOYER: Under the new labor compensation laws of many states the employer is responsible for repair or replacement of artificial dental appliances which are accidentally broken during working hours. For example, an employee might slip and fall or suffer some other type of industrial accident which could dislodge, fracture or damage his denture, break his artificial teeth or ruin his metal clasps. If such an employee is forced to leave his duties for the remainder of the day in order to consult a union clinic or a private dentist the resultant expense can be unnecessarily high. Management must now respect the high cost of lost man-production hours and learn to keep this cost under control. The industrial dentist can contribute much to this goal since he should be available at once.

In addition to reducing the loss in productive man-hours the plant dentist is often able to reduce the actual cost of the treatment or dental appliance. For example, he might find that in case of damage to a dental appliance, construction of a whole new denture at a cost to management of 150 dollars or more is not really necessary. Instead, immediate repair of the appliance could be accomplished at minimum cost, even as low as 10 dollars. Thus, loss of a day or more of working time and excessive treatment costs both would be avoided.

EFFICIENCY OF EMPLOYEES: Plant dental programs also benefit the employee. He is not obliged to go without his dental appliance during the longer period of time needed for repair by a dentist outside the industrial facility. With his masticatory ability impaired for only a minimal length of time his industrial and social obligations could be fulfilled without interruption, his general efficiency would remain unimpaired and his morale would be maintained.

Provision for Newer Benefit Demands

IT APPEARS that in the near future the average worker will not only accept, but even demand the full benefits of modern rehabilitative dentistry when certain repairs become necessary following industrial dental injury. He has become accustomed to the advantages of this comparatively expensive service in recent years by budgeting for it as he does his automobile — on the installment plan.

When this change in the modern concept of restorative dentistry becomes commonplace, a service which provides only temporary repair of an appliance will not be sufficient. Industry must be prepared permanently to repair — or even to service — these modern dental restorations. An industrial establishment that proves unable or unwilling to provide these services directly will also find itself saddled with different prohibitive costs, both of expensive treatments and lost man-hours. Once again, even if unions provide the clinics, management will still have to pay the bills.

Reduction of Health Insurance Costs

INSURANCE companies, also, are about to include liberal dental services in the provisions of their health and accident policies. When this occurs dental services automatically will be included among the fringe benefits for which Industry already pays. Under such circumstances an industrial dental facility will help to keep insurance compensation premiums at a minimum, for these are based upon accident experience.

Recently a committee representing the American Dental Association held a joint conference in Chicago with the Actuarial Committee of the American Health and Accident Underwriters. These underwriters are about to include dental benefits in their new health and accident policies, and have already done so in some cases. Hence, they are now considering the costs of dental service in order to account for this extra coverage in insurance policy premiums.[1] When asked about the new dental rider on a health and accident policy, Jay H. Eshleman, Chairman of the A.D.A. Council of Dental Health, responded, "This rider is indicative of a new trend to develop realistic programs for meeting the cost of dental care."[2]

Policy and Procedures in Dental Emergencies

RESPONSIBILITIES OF THE PLANT DENTIST: The plant dentist must be exclusively designated in the health insurance policy as the person to render all emergency dental service arising from employee claims. Management should insist on this clause, whether treatment is given in a plant dental installation or the private office of the designated dentist.

In certain kinds of special cases extenuating circumstances may warrant the services of outside specialists or perhaps even the employee's own private practitioner. In these cases management should cooperate. The plant dentist must also avoid infringing upon the practice of his local confreres.

Nevertheless, when an outside, private dentist is given permission to institute treatment that dentist should also be informed that only such treatment and fees that have been authorized by the plant dentist will be allowed. Obviously, if the injured employee automatically were permitted unrestricted treatment by a dentist of his own choice, costs to management might rise beyond control.

EVALUATION AND TREATMENT: In order to meet compensation claims immediate examination must be arranged by management following any industrial dental injury. Examination of damaged dental restorations should be included. An adequate evaluation of such dental injury should presuppose a complete pre-employment dental survey and periodic dental examinations. These are now essential.

Immediately following an accident involving jaws, teeth or dental appliances the plant dentist should determine which teeth were actually traumatized and the extent of injury. He should also evaluate the amount of damage to artificial appliances. If the injured employee were allowed to see his own dentist before the plant dentist made his examination the evidence might be effaced. A dental claim might later prove difficult or even impossible to evaluate equitably if immediate treatment were permitted outside the facility provided by the employer.

In some states the statutes permit additional claims to be filed after an original one, provided only that the claims be made within a given time limit after injury. Thus, a claim could be reopened at any time within a grace period such as two years even if the original claim had been settled and an award paid. Such provisions furnish yet another compelling reason for thorough evaluation of compensable injuries by a dental representative of management.

Summary

THE HIGH cost to management of dental injuries and emergencies stems not alone from lost man-hours, but from a dangerously indifferent attitude toward industrial dentistry. With modern health and accident insurance policies increasingly tending to include provisions for dental services this indifference must be abandoned. Industry is now obliged, even though not of its own choice, to consider seriously the need for in-plant or close-by dental installations. Failure to do so will so increase the costs of lost man-production hours and insurance premium rates as to be seriously reflected in management's annual financial reports to its stockholders.

(30 Central Avenue)

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XUM

Barriers To Employment of a Cardiac

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CARDIOLOGY cannot be compared to the exacting sciences of physics and chemistry, but in comparison to some of the other branches of medicine it is relatively scientific. We can measure blood pressure, cardiac output, metabolism, oxygen and carbon dioxide tensions of the blood, venous pressure and other physical measurements which, when combined with clinical observations, allow us to give a fairly accurate appraisal of a patient's work potential. When this work potential is determined, the individual can be directed towards jobs which are within his physical scope.

Such jobs, however, are difficult for the cardiac to acquire in spite of the fact that he is physically capable and is usually anxious and willing to cooperate. The patient may be sufficiently experienced to carry out a job, but certain barriers are placed in his path that prevent his obtaining the position.

The only actual cardiac barrier to employment is reduction in cardiac reserve. In other words, when the ability of the heart to supply oxygenated blood to the body muscles is reduced below the actual work requirement of a job a definite impenetrable barrier is raised. When the cardiac reserve is decreased to this extent the patient obviously must seek employment which requires less physical exertion. For maximum simplicity and for practical purposes insufficient cardiac reserve is manifest by two factors, congestive heart failure and coronary insufficiency, or a combination of both. Congestive heart failure, of course, may be caused by valvular heart disease, disease of the heart muscle, or high blood pressure. Coronary insufficiency, on the other hand, is practically always due to narrowing of the coronary arteries by arteriosclerosis which reduces the blood supply to the heart muscle and consequently limits the ability of the heart muscle to work. Therefore when a cardiologist evaluates a patient for a given job he must determine the efficiency of the heart muscle and valvular system and from this he can fairly accurately determine a man's work potential. However, persons whose physical ability is reduced by cardiac disease are usually in the older age group and consequently their work potential may also be reduced by several other concomitant degenerative conditions. Diseases which are frequently associated with heart disease in the older age group are the complications of progressive arteriosclerosis. Such conditions include intermittent claudication or peripheral vascular insufficiency, cerebral artery insufficiency which may lead to weakness, confusion, incoordination, dizziness, actual stroke and finally degenerative pulmonary diseases such as pulmonary emphysema. Pulmonary diseases of this type reduce the ability of the lungs to oxygenate the blood and consequently require the heart to pump more blood at a lower oxygen tension which in turn increases the work load of an already tired heart. Therefore, the patient's total work potential may be indicated by his cardiac reserve minus his other underlying partially disabling diseases.

Another "road block" is seniority rating. Usually the cardiac patient falls into the older age group and is consequently in a high seniority bracket. A specific example of this type of problem arose in one of my patients with coronary artery disease who was foreman of a state road maintenance division situated high in the Sierra Nevada Mountains. He was physically able to carry out the work of a foreman if he could be transferred to a sea level area. However, the organization of the various sea level areas would not accept a man with his seniority, for it was their practice to fill such positions with men "working up" in their particular division. The patient was not able to carry out the labor required of a general laborer on a maintenance gang even at sea level. Consequently, he was denied work in spite of the fact that vacancies existed, because of civil service protocol. This is a simple example of the security of civil service working in reverse. I am not attempting to discredit civil service, but I am trying to point out the practical barriers that we physicians see placed before our patients.

A more subtle barrier is that of insurability. I now have a patient, age 61 years and a great football player in his college days, who was employed by one of our large steel companies on a job that required a good deal of physical exertion. I was called to his home one evening after supper because of a severe constricting pain in the chest. A diagnosis of acute coronary occlusion was made and the patient hospitalized. His clinical course was exceedingly mild. The pain

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disappeared within three hours. He never developed severe shortness of breath. There was never any suggestion of congestive heart failure. Nor, are there any symptoms at the present time of coronary insufficiency or angina pectoris. This man's coronary occlusion is now completely healed. We know that his cardiac reserve is not as great as it was prior to the attack, but it is certainly sufficient to carry out light work. He could hold a position that might require a person to walk 10 to 15 blocks per day in addition to climbing two to four flights of stairs, and occasionally lifting objects weighing up to 25 pounds. However, he is permanently and completely disqualified from re-employment by that company because of his illness and in view of the statistical probability of his having future attacks. His barrier to re-employment is obviously social and not medical. His company, under present circumstances is justified in its position, because of rising compensation insurance claims and rates.

I have previously pointed out[1] that long litigation in cardiac claims is detrimental to the patient's health, because the afflicted individual loses all insight into the importance of his disease and devotes all of his time and effort to fighting a legal battle for a small monetary victory, which in the case of many cardiacs, comes too late to be of much benefit. If the worker had adequate health insurance he could go to his private doctor and have his heart condition cared for promptly. He would undoubtedly be able to return to work sooner than under the present system where a dubious claim is filed, and the patient's physical condition is lost sight of both by the patient and his attorney. In fact some disabilities are actually prolonged at the present time in order to increase the compensation received. Several years may be lost in such proceedings and the patient's cardiovascular system may become more widely damaged because of inadequate treatment during the course of litigation than if he were cared for by his private physician. Finally when the litigation is completed the worker finds he is unable to return to work because of the barriers discussed above, which would not exist if all cardiac patients were cared for privately and were not considered for industrial accident compensation.

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Changes in Nature of Skill Resulting from Automation

SKILLED action in the broad sense of the term is of many different kinds; but probably the most difficult components of manipulative tasks, as practised by semiskilled operatives on work such as light assembly and which enter into skilled craft operations, are the making of precisely graded ballistic movements. It is characteristic of automatic processes that fine motor control is no longer required and in this respect they seem to make the operator's task much easier. Fine motor actions appear to need continual training if a high level of performance is to be maintained: the "rustiness" of a tennis player at the beginning of the season or of a concert musician out of practice, has its industrial counterparts. There remains a requirement to perform actions in the correct order, but with many automatic machines, especially, for example, with tape-fed machines, the order of actions is worked out once for all at leisure and does not have to be carried in the mind of the operator the whole time. For him, the simpler routine of loading the machine is sufficient, and this can be made common to what would before have been tasks involving many different routines. Automation may also tend to replace fine subjective judgments, such as the colour of molten metal, which may take years to acquire and, like fine graded movements, require continual practice to maintain. Viewing these changes together it appears that automation tends to conserve skill in the sense that it reduces the need for traditional components of skill to be used repetitively, and leaves men to use their unique human capacity for dealing with the complex and the variable in primary construction, in emergencies, and to some extent in maintenance. Even in this last we may doubtless look forward to a kind of "meta-automation" where such items as tool grinding will be carried out automatically. —From A. T. WELFORD in *British Journal of Industrial Medicine*, April, 1958.

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Carcinoma of the Stomach

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PRIOR to a decade ago, carcinoma of the stomach was the most frequent cancer in the male sex. However, within the past decade it has not increased materially and is now superseded by cancer of the lung, which has become the most frequent cancer even when both sexes are considered. It is not possible to state whether the lessened mortality incidence is due to better treatment of gastric cancer. I am inclined to believe it is a combination of both. In any case, it is gratifying that the fatality incidence from cancer of the stomach is less now than it was 10 years ago although far too many people die from the disease and the outlook in cancer of the stomach is not good. As previously reported by us,[5] a review of the results reported from the better institutions showed that the five year survival rates of all individuals in whom a diagnosis of gastric carcinoma was made varied from one to 14%, with an average of approximately 5%. Moreover, Clark[3] found that of all the cases of gastric cancer in the metropolitan area of Houston, only 0.8% survived five years. The fact, too, that 40,000 persons in the United States die annually from cancer of the stomach[7] illustrates that cancer of the stomach is still a disease of serious importance and that everything must be done to increase its curability incidence.

At the Ochsner Clinic, the incidence of gastric carcinoma is one in every 588 admissions. In the Charity Hospital in New Orleans, Boyce[2] found the incidence was one in every 265 admissions, and Berkson and his associates[1] found that one in every 200 patients admitted to the Mayo Clinic had a malignant lesion of the stomach.

For some time we have been convinced that the poor prognosis in gastric cancer has been due to the fact that the diagnosis has been made late and that, with few exceptions, when a clinical diagnosis of gastric cancer is made, the lesion is far advanced and for this reason the outlook is bad. We have emphasized for many years that in order to improve the results in the treatment of gastric cancer, it is necessary to treat the lesion when the cancer cannot be diagnosed. This paradoxical statement means that if one waits until the clinical manifestations are characteristic of gastric cancer, considerable delay has elapsed and the disease is usually far advanced. Whereas this is true of most gastric cancers, it must be admitted that there are exceptional cases in which an extremely small and relatively early lesion causes widespread metastases; and, conversely, a large neoplastic mass associated with symptoms of relatively long duration may still be resectable. It is hazardous, however, to generalize on the basis of exceptions. Although these exceptions do exist, to assume a fatalistic attitude because of these two extremes and to adopt the philosophy, as suggested by Macdonald and Kotin,[4] that regardless of what is done therapy has little to do with the outcome because of predeterminism in the biologic behavior of the tumor, is fallacious reasoning.

There are certain lesions which are associated in a high incidence with gastric cancer and which may be considered premalignant. We are of the opinion that all gastric ulcers should be resected, because, although there is a controversy at the present time as to whether a benign gastric ulcer ever undergoes malignant change, we believe such does occur although probably not so frequently as was considered a quarter of a century ago. It is not beyond the realm of imagination to envision that an ulcer persisting in the gastric mucosa, an epithelium highly susceptible to malignant change, becomes malignant after a period of time. If, however, one is unwilling to admit that a benign ulcer ever becomes malignant, it is impossible for anyone to state by clinical methods that an ulcerative lesion within the stomach is benign or malignant. The roentgenologist, the gastroscopist, the surgeon at laparotomy, and even the pathologist, when he examines grossly the extirpated stomach, are unable to determine whether a gastric ulcer is benign or malignant. Unless serial sections are made through an ulcer, the pathologist cannot be sure there is not an area of carcinoma somewhere in an ulcer. This is illustrated by the fact that for 20 years the Department of Pathology at Tulane University used a microscopic section that was characteristic of a benign ulcer of the stomach. After that period of time, the supply of slides used for students diminished and it was necessary to cut additional sections

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from the same block. To the astonishment of everyone, carcinoma was found in the subsequent sections. If it is possible for the Department of Pathology of one of the major universities to use carcinoma of the stomach for 20 years as a classical example of benign ulcer, it illustrates how difficult it is to make a differential diagnosis. It is for this reason that we believe all ulcers of the stomach should be removed, and that an ulcerative lesion of the stomach, regardless of how benign it appears by all diagnostic methods, cannot be considered nonmalignant until it has been excised and subjected to serial histologic examination. Gastric polyps, either single or multiple, are premalignant lesions and should be excised. Not infrequently chronic gastritis, particularly that associated with pernicious anemia, undergoes malignant change and individuals with this condition must be followed with extreme care, because it has been shown by Rubin and Hodges[6] that the incidence of gastric cancer in patients with pernicious anemia is 10 times as high as in those without pernicious anemia. They also found that gastric cancer developed in 2.5% of all cases of pernicious anemia.

At the present time, there is only one curative treatment of carcinoma of the stomach and that is complete surgical extirpation of the malignant process. Palliative resection of the stomach is justified, but, of course, it is not a curative procedure. In order to determine the results obtained in our own institution, we studied all the cases which were seen up to a little over five years ago, analyzing all the cases seen in the Clinic from 1942 through 1950. It is assumed that all nonsurvivors died of the disease, which, of course, is not true, because the five year survival rate in the general population without cancer for this same age is only 85%. Therefore, our results are actually better than they would seem, because we have not excluded those cases which have died of some other condition. There were 196 patients with gastric carcinoma who were treated over five years ago. Eighteen of these patients were well and apparently free from the disease more than five years following gastrectomy. Two of them subsequently died, one of cerebrovascular accident 10 years after operation and the other of cirrhosis of the liver established by liver biopsy more than six years after gastrectomy. One hundred ninety-three of the 196 patients (98.5%) have been followed. The other three cases we presumed have died, but they are excluded from the analysis.

Of the 193 cases, 175 (123 men and 52 women, a ratio of 2:4) died within five years. Of the 18 patients who survived five years or more than five years, nine were men and nine were women a ratio of 1:1. Of the 132 men seen over five years ago, nine survived (6.8%) and of the 61 women, nine also survived (14.7%). It is thus seen that the survival rate in women is over twice as high as it is in men. It is of interest that we have obtained similar results in carcinoma of the lung. Although there was some variation in the ages of the two sexes, the variation was not very great. The age distribution in men was: 30 to 39 years, 4%; 40 to 49 years, 12%; 50 to 59 years, 29%; 60 to 69 years, 39%; 70 to 79 years, 13%, and 80 to 89 years, 3%. For the women, these respective percentages were 13, 11, 21, 39, 13, and three.

Aside from dysphagia, the clinical manifestations or symptoms had little to do with the prognosis. Whereas 17% of those who did not survive five years had dysphagia, none of the five year survivors had dysphagia. Dysphagia undoubtedly represented involvement of the cardiac region of the stomach, and none of these patients survived. Pain was present in a high percentage of the survivors and the nonsurvivors, 83% and 92%, respectively. Nausea was present in 61% of the survivors and in 60% of the nonsurvivors. Anorexia was present in 30% of the survivors and in 49% of the nonsurvivors. Of great importance as regards prognosis was the duration of symptoms, but it was different from what one would ordinarily expect in that the five year survivors had a longer history (11.3 months) than the nonsurvivors (7.6 months). This paradoxical finding is due either to the fact that many of the survivors originally had a benign gastric ulcer which subsequently became malignant or that many were slow-growing neoplasia, which progressed relatively insidiously and the lesion was still curable although symptoms had existed longer. Ulcerative carcinomas of the stomach offer a better prognosis than do polypoid or infiltrative lesions. It is of importance that even those patients who have had symptoms for a relatively long period of time should not be denied surgical treatment. Also of considerable prognostic importance is the degree of weight loss. Although most of our patients lost weight (83% of the five year survivors and 92% of the nonsurvivors) the weight loss was most marked in the latter group. There was an average weight loss of nine pounds in the five year survival group and an average of 26.9 in the nonsurvival group. The other physical findings were: tenderness, five year survivors 50% and nonsurvivors 53%; simple vomiting, five year survivors 50% and nonsurvivors 50%; palpable mass, survivors 33% and nonsurvivors 46%; retention vomiting, survivors 11% and nonsurvivors 22%; palpable spread, five year survivors none and nonsurvivors 22%; melena, five year survivors 17% and nonsurvivors 19%.

In one-third of the five year survivors there was a previous history suggestive of peptic ulcer,

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whereas this was obtained in only 8.5% of the nonsurvivors. Sixty-seven percent of the five year survivors and only 19% of the nonsurvivors had ulcerative lesions. This supports our contention that all ulcerative lesions of the stomach, regardless of how benign they may appear, should be resected. The location of the tumor in the stomach apparently had a great deal to do with prognosis as well. Of these cases, the location of the tumor was in the pylorus in 43% of the five year survivors and 10% of the nonsurvivors; in the greater curvature in 17% of the five year survivors and 5% of the nonsurvivors; in the lesser curvature, 17% of the five year survivors; in the greater curvature in 17% of the antrum in 17% of the five year survivors and 12% of the nonsurvivors; in the fundus in 6% of the five year survivors and 8% of the nonsurvivors; in the cardia in none of the five year survivors and 14% of the nonsurvivors; in diffuse involvement of more than one-half the stomach in none of the five year survivors and in 41% of the nonsurvivors. It is thus seen that lesions of the pylorus, antrum, and curvatures offer a better prognosis, and that lesions of the cardia, fundus, and diffuse lesions offer a poorer prognosis.

Of equal importance, as mentioned previously, the type of lesion pathologically has a great deal to do with prognosis. Of the five year survivors, 67% had ulcerative lesions, 22% polypoid, and 11% diffuse. Of the nonsurvivors, 73% had diffuse lesions, 8% polypoid, and 19% ulcerative.

That not all of the five year survivors appeared to be favorable cases is shown by the fact that in 28% of the five year survivors there was extension beyond the stomach to the regional lymph nodes or to other structures at the time of operation, and in only 72% was the lesion apparently limited to the stomach. Of the nonsurvivors, there were only 5% of cases in which the lesion was apparently limited to the stomach, 7% refused operation, 13% had lesions so far advanced when first seen that nothing was done, 28% had exploration alone, 47% had some type of operative procedure even though there was extension beyond the stomach, 25% had a resection, and 22% had some operation other than resection.

As stated previously, there is only one curative treatment of gastric carcinoma and that is surgical extirpation. Although there is some controversy whether the treatment should be total gastrectomy or radical subtotal gastrectomy, it is our belief that in most cases the latter procedure is preferable. Of our five year survivors, all but one was treated by radical subtotal gastrectomy. We believe that the morbidity rate is definitely less following a radical subtotal gastrectomy than following total gastrectomy and that, if the survival incidence is no higher following total gastrectomy than following radical subtotal gastrectomy, the latter is to be preferred. It is imperative, however, that a radical subtotal gastrectomy should be done if anything less than total gastrectomy is performed. It is our policy to remove the gastrohepatic omentum, the gastrocolic omentum, and greater omentum, all of the lesser curvature including the first portion of the duodenum and extending up to the esophagus, all of the greater curvature to within five or six centimeters of the cardia including the spleen and gastrolienal ligament, the lymph nodes around the celiac axis and the left gastric vessels, the periesophageal nodes, the subhepatic nodes, particularly those in the portal fissure, and the nodes superior and inferior to the duodenum. We believe that no attempt should be made to perform a Billroth I type of operation, but the duodenum closed blindly and the first portion of the jejunum brought up through an opening in the transverse mesocolon and anastomosed to the lower portion of the gastric pouch. Following this procedure, there is usually a paucity of symptoms and most of the individuals get along quite well. They are not gastric cripples as frequently happens after a total gastrectomy. The reason for the paucity of symptoms is not a result of the gastric reservoir from the small gastric pouch, which is no larger than a man's thumb, but a result of the preservation of a few left vagal fibers. A total gastrectomy was employed in our series only in patients with diffuse disease and in those in whom the lesion was situated in the upper portion of the stomach. Of the 193 patients, 13 had total gastrectomy with a hospital fatality rate of 30%. In 10 cases the lesion had extended beyond the stomach at the time of operation and in only three was it apparently limited to the stomach. All of the former group and two of the latter group died within five years. One of the latter group lived longer than five years. In six patients a proximal, subtotal type of resection was performed with a hospital fatality rate of 50%. None of these proved to be curative and no patient survived more than two years. Radical distal subtotal gastrectomy was performed in 53 patients with a hospital mortality rate of 7.5%. In 19 of these, the lesion was apparently limited to the stomach, and in this group the five year survival rate was 63%. In 34 in whom the lesion had extended beyond the stomach, the five year survival rate was 14%. Of the entire 193 patients, resection was performed in 72 (37%). Of the 72 patients in whom a resection was performed, the lesion had extended beyond the stomach in 50 (70%) and was apparently limited to the stomach in 22 (30%). Of the group of cases in which the lesion had apparently extended beyond the stomach, 10% survived five years, and of the 22 in which the lesion was apparently limited to the stomach, 13 (59%) survived five

years. As mentioned previously, these statistics show that although extension beyond the stomach does alter prognosis, it does not necessarily mean a hopeless outlook, because 10% of these individuals were alive and well five years later.

Because the results in the treatment of gastric cancer are not good (9.4% survivors in our series seen over five years ago), it is imperative that everything should be done to improve the results in the treatment of these unfortunate individuals. Although there are many factors which affect prognosis, it must still be emphasized that early diagnosis and the institution of curative therapy at a time while the lesion is still limited to the stomach is the only method of therapy which offers much hope. It is thought by some persons that early diagnosis plays no part in cancer of the stomach. Macdonald and Kotin[4] stated: "The concept that early diagnosis of carcinoma of the stomach may improve end-results is not only fallacious but is in fact the reverse of the truth." Although it is readily admitted that there are patients who have highly anaplastic lesions and in whom early extension occurs before there is much clinical evidence of the disease, this represents the exception, and to generalize on the basis of exception is not only unscientific but also hazardous. To assume a complacent attitude as regards gastric carcinoma means an increasing number of persons dying from this disease who might otherwise be saved. It is only by suspecting carcinoma more frequently and treating lesions which clinically are not cancer that the survival incidence in gastric malignant neoplasia can be prolonged. As mentioned previously, the extirpation of all gastric ulcers, regardless of how benign they may appear, will not only pay dividends as regards complete relief of symptoms, because results following surgical treatment of gastric ulcer in contrast to duodenal ulcer are very much better than the conservative treatment; but also it will mean that those lesions which are already malignant, although they appear benign or may undergo malignant change, can be treated at a time while the condition is curable in the former instance or even preventable in the latter instance. Also, other lesions which are known to be premalignant, such as polypi and chronic gastritis, particularly associated with pernicious anemia, should be treated either surgically or, in the instance of chronic gastritis associated with pernicious anemia, watched with extreme care because of the inherent tendency to develop a gastric cancer.

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Jobs: His and Hers

During the postwar decade, the percentage of married couples with both husband and wife working has steadily increased. The rise reflects the steady uptrend in labor-force participation of married women whose children have reached school age. The U. S. Bureau of the Census reports that the number of working couples reached a record 10.8 million in the spring of 1957, 28% of the estimated 38.9 million married couples in the nation. At the end of World War II, the proportion of families with both husband and wife in the labor force was only about 20%. Even in 1957, however, the large majority of married couples (24.4 million or 63%) followed the traditional pattern—the husband the breadwinner, the wife a full-time homemaker. —From *Supervisory Management*, July, 1958.

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The Immobilization of Fractures

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A FAMOUS surgeon who, when asked how long a certain fracture should be immobilized, said "until it is healed." The statement, "until it is healed," is essentially correct; its only fault is its incompleteness. Healed for what? Weight-bearing or just to support the weight of a distal phalanx? For a sitting job or for hopping freight trains? Healed for whom? A child or an octogenarian? An athlete or an executive?

As an example, take the case of an anterior dislocation of the shoulder. It could be correctly aphorized that this injury should be immobilized for three weeks in internal rotation, lest recurrent dislocation develop and necessitate reconstructive surgery. But in the group of folks in the second half of their existence, recurrent dislocation, although possible, is far less likely a complication than periarthritis or frozen shoulder. Therefore, this group should be exercised in a sling within two to four days and should be encouraged to develop a full range of motion in the earliest possible time. All aids to this such as cortisone and physiotherapy are used. But what if the same person has in addition an avulsed greater tuberosity which makes early active motion inadvisable? In this case it is perhaps best to allow 10 to 12 days for some early callus to form in this cancellous rapidly healing area and then push for motion. If the tuberosity is displaced, open secure fixation and immediate mobilization are indicated. Periarthritis must be avoided at all costs — but, of course, it is not always avoided or even usually avoided. The gluing down of the capsular structures in the shoulder in the "second half" age group is a very potent force and even in the best of hands months or years may elapse before full motion is restored. The main point is that as the situation varies, so must the treatment.

In the case of a long bone fracture, we are beset by two seemingly conflicting principles each of which is incontravertible. On the one hand, we have the assurance of Watson-Jones and his predecessors that "immobilization, enforced, uninterrupted, and prolonged" is the main precept in long bone fractures. On the other hand, Lucas Champonniere headed a school recommending early motion of the joints adjacent to fractured bones, feeling that thereby earlier restoration of function would be accomplished, and the healing of the fracture would not be interfered with.

It appears that judgment in the proper management of a fracture consists of determining the temporal relationship between adequate immobilization and functional restoration.

In the majority of fractures, the experienced orthopaedic surgeon will have little difficulty in determining these time relationships. Let us take some typical examples of fractures and see if we can reason out their treatment.

In the fingers we do not fear nonunion but only malunion and stiffness. Therefore the time of immobilization should be minimized and function begun early, just as soon as sufficient callus has formed to prevent angulation and malunion and long before callus appears on the x-ray. This is usually about three weeks for the phalanges and perhaps four weeks for the metacarpals. Only the actually fractured bones and their adjacent joints should be immobilized so that nearly full function of the remaining fingers is possible. Moreover, the joints are always immobilized in flexion since their ligaments are eccentrically placed to tighten in flexion and loosen in extension. If we allow contracture in extension, the flexed position may not be later achieved, but the opposite contracture is not nearly so likely to be permanent. This is especially true of the metacarpal-phalangeal joint.

But failure to provide a short period of immobilization for phalangeal joint fractures and dislocations frequently results in a chronic painful joint. A short period of specific rest and early mobilization is clearly the best therapy.

How different the carpal scaphoid fracture. Here stiffness even following prolonged immobilization is unimportant, whereas the complications of nonunion are all too often traumatic arthritis, stiffness, pain and surgery, sometimes even arthrodesis. If union is not present within six months, it is advisable to bone graft this fracture owing to the danger of these complications.

Recurrent dislocation of the elbow is rare. Stiffness of the elbow is common following injury. Therefore, should we immobilize the dislocated elbow? Yes, we certainly should, but for an entirely different reason. Here, at the elbow joint, tearing of the closely approximated muscle

fibers is the rule, and unless we allow sufficient rest for absorption of the hematoma and to protect this elbow musculature against further minor hemorrhages from manipulation, we are in danger of myositis ossificans and progressive stiffness. The average time of immobilization should be from two to three weeks depending upon the clinical appearance of the soft tissues about the elbow. A minor crack in the head of the radius was immobilized one week and then the slightly stiff elbow was forcibly manipulated by a well-meaning physiotherapist until "the tears had run out of my eyes." The x-rays showed where the sensitive elbow musculature tore, bled a drop of blood for each tear, and then ossified. This is particularly evident in the region of the triceps muscles. This would be a valuable trick for the orthopaedic surgeon if he could accomplish this when he wanted to fuse an elbow because that is what the patient has, a complete fusion.

Actually the ideal treatment for an undisplaced or slightly displaced fracture of the radial head is aspiration of the hemarthrosis, rest for four or five days and then early motion to mold the fragments into position and to maintain motion. It is desirable for the patient to wear a protective posterior plaster splint in which he can work; he then removes the splint for careful exercises several times a day. Under no circumstances should it be exercised passively. In fact, I believe it is a good rule never to send an elbow injury to physical therapy for mobilization. The patient, properly instructed, can do it better and safer himself. The modalities have little or nothing to offer him except time away from his job and are no more effective than beatified hydrogenated oxygen.

The Colles fracture has as its most common and worst complication, stiffness of the hand and shoulder. Therefore, the primary aim of therapy should be to avoid these disasters. Is it accomplished by early mobilization of the fracture? No! The hand can be better exercised if the painful wrist is immobilized provided that the extreme position of pronation and flexion are not used. We advocate a reduction under local anesthesia, immobilization in slight flexion and ulnar deviation and little if any pronation, and push for early full motion of the fingers and shoulder. It takes six weeks to heal this fracture and nothing appears to be gained by earlier mobilization of the wrist. The wrist will limber up provided that the hand is kept flexible.

There are Colles fractures so comminuted that some form of continuous traction is desirable. I prefer the Boehler technique of Kerschner wires through the metacarpals and olecranon. These wires, incorporated in the cast, prevent slipping of the fracture and do not interfere with motion of the hand and shoulder.

Fractures of the spine, without neurologic damage, used to cause much more disability and time loss than at present. In the past 10 years, many surgeons, but not all, have begun to treat the compression fracture in the vigorous, healthy male the same as he had treated the menopausal osteoporotic compression fracture for years, namely by a short period of bed rest, 7—10 days, then immobilization for about six weeks in a plaster jacket or even in a corset without any attempt being made at reduction. To disengage these impacted fractures and hold them hyperextended for four months (a treatment still recommended in certain medical centers) invites recurrence of the deformity, is accompanied by a longer period of pain and results in many cases in stiff lumbar spine. Often these patients would complain of pain in the hyperextended lumbosacral joint long after the pain from the actual fracture had disappeared. We have had men return to light work in their plaster casts in three weeks and to full work in three months by our more recent methods whereas 6—12 months was a more likely time for full functional restoration with the hyperextension method.

In the case of long bone fractures not involving the joints, it is evident that union is the main objective and nonunion the main complication. Stiffness of the adjacent joints is of secondary importance since it makes but little sense to have a full range of knee and ankle motion if there is nonunion of the tibia. Likewise, stiffness of mild degree is not so disabling in the lower extremity as in the upper and is less likely to be permanent. The prime functional requirements of the upper extremity are mobility and facility; in the lower extremity they are stability and endurance.

So it is evident that fractures of the tibia and femur will require far longer periods for healing and will be associated with very much longer disability periods. An uncomplicated tibia or femur fracture should be thought of as needing a minimum of six months total disability and many will not be ready for work even at that time. Compounding seems nearly to double the healing time in many cases especially of the tibia and ulna.

Intramedullary fixation has freed the femur fracture from the long period of traction and spica and has preserved normal function of the knee joint, but does not diminish the healing time and increasing numbers of nonunions are appearing because of failure to recognize this fact. Just to operate on a femur or tibia is certain to increase the time necessary for solid bony union due to the disturbance of the fracture hematoma, though, of course, other considerations often outweigh this fact. In my opinion the femur fracture should usually be operated

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upon and the tibia fracture rarely except in case of grossly displaced oblique fractures. In general, intramedullary fixation is far superior to bone plate fixation which tends to hold the fragments apart in the healing process, prolongs the healing time and increases the time of disability and incidence of nonunion.

In the humerus shaft fracture, surgery is not often indicated, but when it is, intramedullary fixation seems to give the best result and allows the earliest mobilization of shoulder and elbow. Stiffness of the shoulder often follows in the older age group, but not usually in the elbow. This tendency to stiffness can be countered by early exercises of the shoulder carried out in a sling, usually after about two weeks, if secure internal fixation has been obtained.

Displaced forearm fractures so routinely go onto nonunion or malunion that surgery with primary bone graft and intramedullary fixation appears to be the best method of treatment available at present. Prolonged cast immobilization is necessary even with the internal fixation but if the hand and shoulder are kept mobile, severe stiffness is not likely.

In fractures involving the joints, malunion and stiffness are the main complications. Surgery is often indicated to restore the joint. This is particularly true of the depressed lateral plateau of the tibia, the various types of displaced ankle malleoli, the os calus fracture, and the capitellum, head of the radius and the olecranon. Secure fixation can be obtained and motion begun as soon as the sutures are removed, although weight-bearing may not be allowed for considerable periods to prevent crushing down of the soft new bone in these areas.

The use of the walking cast in injuries to the foot and ankle has great advantages if its use is proper. To keep a leg weight bearing even in a cast will result in a far quicker return to normal activities and minimizes reflex sympathetic dystrophy. Its indiscriminate and premature use in certain ankle fractures, however, have led to severe disability requiring ankle fusion. This is particularly true in the case of the oblique fracture of the lateral malleous with unrecognized deltoid ligament injury. Rotation is allowed in the short leg cast and a follow-up x-ray shows widening of the medial joint space between the medial malleolus and the talus indicative of deltoid ligament injury and lateral displacement in the ankle mortise. A long-leg cast correctly applied is indicated in this injury, and careful clinical examination should be done to rule out the injury on the medial side of the ankle in every case of lateral malleolus fracture.

Perhaps you were led to expect a discussion on the method of deciding when sufficient union has taken place to discontinue immobilization. If so, I must disappoint you here because I can only write in the broadest terms about this topic. The x-ray will only help if it shows obvious union or obvious lack of union. It is usually somewhere in between. Here the surgeon resorts to rule of thumb — A Colles fracture is healed in six weeks; to clinical evidence of union — lack of tenderness and no sign of motion at the fracture site; to the age of the patient — a youngster will heal much quicker, but must be protected relatively longer because of the all or none law in children; and finally he resorts to his experience and training. This latter fact accounts for the rather wide variation from individual to individual in the time that fractures are kept immobilized.

There is one private rule of thumb which has stood the test of time better than any other. If union is questionable, continue immobilization. If union is present but not advanced, continue protection but use a bivalve cast to allow motion. This latter is part of a general program to allow staged-progression in mobilization, rather than to treat the case as though there were only two choices — full immobilization or full mobilization such as is true with small children.

Summary

THIS paper emphasizes the temporal relationship between immobilization and motion as they vary with the location of the injury and with the many imponderables inherent in the patient. A planned approach, specifically designed for the individual patient, will afford the largest number of successful results with the smallest number of permanently disabled patients.

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Injury Litigation Among Railway Employees

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STATISTICAL studies of the annual cost to American Railroads of personal injuries disclose an alarming increase in recent years despite a pronounced reduction in number of such injuries. During the war years, 1941 to 1945, an average of 55,000 railroad employees were injured each year at an average cost of $50,000,000 per year or $917 per case. In contrast, in the five year period, 1951 to 1955, the average number of railroad personal injuries in each year was reduced to 30,000, a drop of approximately 45%. However, the average cost per year in this latter period reached $97,000,000 or $3,223 per injury, an amazing 350% increase. This emphasizes the necessity of maintaining constant liaison between the medical and claim departments of the railroads in order to prevent the cost of individual injuries from wiping out the benefit of the railroads' improved safety record.

The purpose of this paper is to stimulate medical personnel to a more thorough and careful approach in the examination and treatment of injured persons in order to decrease personal injury litigation. Although numerous factors are responsible for law suits, a common one is the failure of the attending surgeon properly to evaluate the patient from the standpoint of both injury and litigation. The surgeon is in the delicate position of having three different interests to satisfy — his employer, his patient and the latter's labor representative. In addition to these, he is further subject to the scrutiny of the legal and medical representatives of the unions. Therefore, a knowledge of medical jurisprudence is a necessary adjunct in the treatment of every injured employee since courts expect physicians to give their patients proper diagnosis and treatment. Negligence and mistakes of judgment often lead to malpractice suits, with ensuing excessive financial settlements. It is most important for company surgeons to realize their limitations and to recognize the need for early consultation by specialists. Neglect here may be most costly.

Role of Medical Examiner's Office

IN ORDER to assist in this program, the Baltimore & Ohio Railroad's district medical examiner's office, in conjunction with the district claim and safety departments, has established definite policies and procedures to be followed in all cases, especially for those which are apt to produce legal entanglement. This entails the proper diagnosis, treatment and evaluation of each injury regardless of apparent triviality. When necessary, it requires the additional services of outstanding medical and surgical consultants who have access to all modern diagnostic and therapeutic measures.

The initial assault on the problem should originate in the employment office where applicants are interviewed and screened. From a medical standpoint, all pertinent information from prior employers, including record of compensation claims and settlements, should be available to the medical examiner at the time of examination. Unfortunately this is frequently impractical and impossible because of the time element involved, although the medical department has a 90 day probation period following original examination during which the past medical history can be obtained for purpose of final acceptance or rejection of application. Hazardous railroad positions preclude the employment of applicants with a history of skull or spine fracture, serious back injury or operation, epilepsy, chronic dermatitis and chronic disease. This includes the more important, but only a small portion of the many causes for medical rejection.

For best results, male applicants should be examined in private, quiet, clean surroundings. Completely stripped of clothing, including shoes and stockings, a search is made for evidence of congenital anomalies, such as spina bifida or the talipes deformities (clubfoot). Also, the entire spine is inspected for incisional scars which indicate "disc" surgery, a fact generally withheld at time of interview.

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Weight standards, in accordance with height, have been increased to assure physical capacity for train service and arduous duties. Since many back injuries have occurred in persons actually too frail for their tasks, the prior standards have warranted increases.

Routine use of pre-employment x-ray examination of the low back, owing to its controversial nature, is not a policy of the Baltimore & Ohio Railroad medical department, although some railroads and other industries consider it advisable. In our district, of the 21 trainmen who sued the company between 1953 and 1957, only four had back injuries. Total financial settlement did not exceed $40,000. During this same period, approximately 1,900 new trainmen were examined. Had all been subjected to spine x-rays at $30 per examination, the additional expense of $57,000 would have been incurred without benefit to the program since the lumbosacral x-ray findings in all four cases were normal; hence they would not have been rejected at time of employment.

Role of Claim and Safety Departments

DESPITE adequate and proper treatment of the injured worker by the medical department, some take legal action in the hope of obtaining a larger financial settlement than offered by the claim department. In fact, a review of 490 serious personal injury cases (fractures or disabilities exceeding 72 hours in duration) in the Baltimore medical examiner's office between 1953 to 1957 inclusive reveals litigation in approximately 34 cases or 6.93%. Of the 34 cases 21 or 61.7% were train or yard men, thus indicating the group of employees most likely to seek legal recourse against the company for accidental injuries.

No phase of medicine or surgery is exempt; every injury is potentially a medicolegal one. Improper or insufficient treatment often leads to consultations by experts especially trained in that field and used by the patient's attorney. In direct contrast overtreatment by our surgeons is also undesirable since jurors are impressed with extent and duration of treatment. Therefore, the district claim agent, with his office of trained investigators, is kept informed of all accidents and frequently confers with the local medical examiner concerning selected cases.

A department of the railroad which is instrumental in reducing the casualty (injured or killed) rate is the safety department. This consists of employees trained in railroad service and familiar with its mechanisms. Its function is to reduce accidents, primarily through an educational program which is assisted by the medical examiner. The Baltimore & Ohio Railroad Company's Safety Department was organized in 1921. On the basis of 145,619,000 man hours worked that year there was a casualty rate of 30.10 with 53 killed and 4,325 injured. This is in marked contrast to current statistics which reveal a casualty rate in 1956 of 5.10 based on 96,834,000 man hours, with 21 killed and 473 injured. These records as maintained by the department in conjunction with Interstate Commerce Commission regulations governing monthly reports of railroad accidents (November 23, 1956), prove the value of the safety program in reducing the casualty rate of the Baltimore & Ohio Railroad Company.

Medicolegal Case Histories

IN ORDER to exemplify medicolegal problems of industrial medicine in the railroad industry and the important function of the medical examiner's office some selected case histories are presented.

Case No. 1 (Ophthalmologic): A cook, dining car department, age 60, on duty at Cincinnati, Ohio, November 21, 1956, suffered minor trauma to the right eye when splashed by hot grease. He was treated there by a company ophthalmologist who made a diagnosis of "mild conjunctivitis." Four months later, he visited my office in Baltimore claiming loss of vision in the right eye secondary to the aforementioned injury. Examination revealed a mature cataract of the right eye, possibly on a traumatic basis. The eye consultant was contacted. Fortunately, on November 21, 1956, he had noticed an opacity in the right lens, and had recorded vision of 20/80 in that eye. It was thus apparent that the employee had been suffering from an incipient cataract at the time of injury and was attempting to establish company responsibility. When confronted with this information, he admitted the facts and withdrew the claim.

Handled improperly, it could have cost the company approximately $10-15,000 with a life long responsibility attached to the defective eye. It stresses the importance of vigilance and thorough investigation. It proves the advantage of visual acuity examination during treatment of corneal foreign bodies and irritations.

Case No. 2 (Pulmonary): A boilermaker, aged 61, became disabled September 16, 1957. Chest x-ray at a local hospital was interpreted as showing silicosis, on an occupational basis. He was advised to undergo complete medical survey, at company expense, in order to have the pulmonary pathology properly evaluated. He refused, but later was admitted to the same hospital where silicosis had been diagnosed. Chest plates revealed pleural effusion, and cytological study of the aspirated fluid was positive for malignancy. He died January 2, 1958, and diagnosis was

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changed from silicosis to carcinoma of the lung. The company was absolved of all responsibility. A recent chest x-ray survey shows lung malignancy in our shop workers is uncommon.

This emphasizes the importance of correct diagnosis, especially when it is based only on an interpretation of an x-ray film. Hypothetically, had the boilermaker died because of the alleged silicosis, without adequate study, the railroad may have been sued on the ground that occupational hazards were the responsible factors in his death.

Case No. 3 (Orthopedic) Back Injury: A janitor maintained that on June 11, 1954, he fell from a 5 ft. ladder and injured his back while at work. He was referred to our consulting surgeon who made a diagnosis of low back spasm, since x-ray examination of the spine was negative. He engaged legal counsel and instituted suit against the company for $75,000 claiming 25% permanent disability to the back, as determined by his attorney's orthopedist. On July 7, 1955, he visited my office and I was impressed by his well dressed appearance, inasmuch as he claimed he was supporting a large family and had not worked since June 11, 1954. I recommended an investigation of his daily habits and the claim department was able to determine that he had been working regularly for a local manufacturing concern. When confronted with the fraud his attorney immediately dropped the suit, and the company saved substantially through alertness of the medical examiner and cooperation of the claim department.

Case No. 4 (Surgery) Hand: A Yard Helper, on November 21, 1954, suffered compound comminuted fractures of right thumb and index fingers when they were crushed by a gondola end gate. He was treated by one of our consulting surgeons, who used conventional banjo splinting with plaster cast. When it was apparent the bones were not uniting and that the two fingers were valueless, he was referred to a surgeon specializing in hand surgery. Following two operations, which included bone grafts and tendolysis procedures, the injured employee was permitted to resume duty on March 1, 1956, with a permanent partial disability of 20% loss of use of the right hand. Expenses involved about $900 for hospitalizations and physiotherapy, plus a $10,600 settlement by the claim department.

In the past, hand injuries have been treated by our industrial surgeons. It is now evident that much disability, expense and discomfort can be eliminated by referring, within 24 hours following injury, all serious hand injuries (comminuted fractures, tendon lacerations, etc.) directly to a surgeon who is skilled in that field.

Case No. 5 (Surgical) Fracture: A cook, dining car department, suffered injury to chest and back as a result of a train derailment. A Pennsylvania hospital diagnosis was as follows: "Fracture right 6th and 12th ribs — no fracture in dorsal or lumbar vertebra." He promptly engaged an attorney in Baltimore who referred him to a Philadelphia group which specialized in such cases. X-ray report from a New York physician stated: "Fracture right transverse process of 3rd lumbar vertebra, herniation of 3rd, 4th & 5th lumbar intervertebral discs, fracture dislocation of coccyx." He was then sent to our consulting roentgenologist in Baltimore who made this diagnosis: "Old healed fracture right 12th rib, essentially normal lumbar spine." As a result of the injuries, he instituted suit against the company in the amount of $100,000 and was awarded $12,500 on the basis of total and permanent disability. Yet approximately one year after settlement he visited me requesting authority to resume duty. He felt the railroad was obligated to furnish him work.

The fracture problem is monumental in all phases of railroad work since it can involve either office clerks or laborers performing hard, arduous duties. Company surgeons and consultants must not rely completely on clinical judgment but should be fortified with x-ray plates to support their diagnoses. Emergency wet plate x-ray examinations as performed by technicians and interpreted by internes or residents, should be reviewed by a roentgenologist before the patient is told the findings, as skepticism is created when a diagnosis is altered.

Case No. 6 (Dermatologic): A boilermaker developed dermatitis of upper extremities, face and neck which he claimed was due to occupational contact with sensitizing agents. He was referred to a dermatologist who diagnosed the eruption as contact in nature owing to allergy to diesel oil. He attempted to resume duty on a few occasions, but suffered relapses despite absence of contact with the offending agent. In fact, he was so sensitive to the oil that exposure to fumes from the exhaust of a transit bus produced recurrence of the dermatitis. On the basis of the occupational disability, he was granted an annuity by the Railroad Retirement Board. At the same time he instituted suit against the railroad in the amount of $60,000.

Dermatitis has become a dreaded word in railroad terminology because of the excessive financial awards to plaintiffs. As an example, under the Federal Employers Liability Act, the Seaboard Air Line Railroad Company was found liable for an occupational contact dermatitis developed by one of its employees in 1947 (Seaboard Air Line Railroad Company vs. Ford, Florida, October 19, 1955 — 92 So. 2nd 169). A jury award of $47,500 to the plaintiff was disallowed only because of statute of limitations.

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It is becoming our established policy to refer all skin irritant cases to a recognized dermatologist for opinion as to company liability. Precautions should be taken to minimize contact dermatitis by furnishing employees with protective equipment (gloves, aprons, shields, goggles, etc.) and by assigning them to duties which will not require contact with the sensitizing agent. Use of protective ointments and lotions are not recommended because of their questionable value and possible sensitization effect.

Case No. 7 (Psychiatric): A Yard Helper, on duty March 1, 1955, was thrown from a moving engine to the ground. He suffered abrasions of nose and forehead, contusions of pelvis, back, right shoulder and left hand. He was referred to our surgeon but it was later agreed to utilize the services of his personal physician who sent him to an orthopedist. The diagnosis of the latter was "Ruptured intervertebral disc, lumbar region." Consultation was arranged with our neurosurgeon who could not find any evidence of ruptured disc or back pathology and advised patient to resume duty. The case remained quiescent until July, 1957, when he visited the claim agent with many bizarre complaints (dizziness, hyperirritability, auditory hallucinations, nervousness, back pain) which he associated with the accident of March 1, 1955. It was decided to have further examinations performed by a neurosurgeon and psychiatrist who felt he was suffering from a paranoid-depressive psychosis and recommended psychiatric treatment.

This man has been obsessed since March, 1955, with the idea that he is suffering from a ruptured intervertebral disc, despite all negative findings by our consultants, who are well qualified in that field.

Suggested Corrective Measures

1. PRE-EMPLOYMENT examinations to be performed only by full time railroad physicians.

2. Establishment of a stringent pre-employment examination program for train and enginemen should be instituted in order to assure their physical qualifications. This is the group of employees most prone to use litigation in settlement of their personal injury claims. This should include: (a) Determination of visual acuity, depth perception and color sense by means of modern electric equipment, in lieu of the antiquated wall chart and color skeins. (b) Audiometric determination of hearing acuity should be adopted to supplant present inadequate and inaccurate methods. (c) Electrocardiographic tracings should be obtained to disclose any abnormalities. Attacks of coronary thrombosis in many states are now classified as compensible, when suffered on duty secondary to physical or emotional strain. (d) Notwithstanding what has been said elsewhere herein concerning the cost of pre-employment back x-rays, the problem in some areas is so acute that it would be advisable to include x-ray examinations of selected groups, especially if the organization operates its own x-ray equipment.

3. The problem of alcohol, ataractics and antihypertensive drugs becomes of paramount importance from the safety standpoint.

4. A medical examiner, trained in forensic medicine, should be available to the claim department for consultation regarding medicolegal cases.

5. Medical and surgical experts should be consulted more often in order to assure best possible therapy and end results, thus protecting both employer and employee.

6. Standard procedure should be initiated requiring all new nonclerical employees to be immunized against tetanus, using toxoid vaccine, since serious, costly reactions have resulted following administration of the antitoxin.

Conclusion

A REVIEW of the medicolegal problems confronting the railroad industry has been presented. Suggestions have been made toward improvement. The medical and claim departments of railroads should strive to obtain the best possible results, both for the injured employee and the company, in order to reduce litigation to a minimum.

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Geriatrics and Retirement

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NO CIVILIZATION can be whole with 10,000,000 idle persons in its midst, even if these are the group we call the aged. The idleness I speak of is not mere commercial unemployment. It is the total idleness that includes loneliness, a sense of rejection and of useless living.

Physically, socially and emotionally many older persons have become burdens to themselves, their relatives, the crowded city, the clinics and the too few institutions where they apply in desperation for care. With every admission of an older person whose basic difficulty is only a feeling of insecurity, incompetence and rejection, there is less room for those who actually need custodial care.

Recent studies of old age are changing many of our commonly accepted concepts. A life span of only 50 to 80 years is the result of abnormal conditions, not a time limit set by nature. In part, premature old age is caused by social conditions, cold, hunger and poverty which weaken the human organization. The rapidly increasing older population in America is evidence of the fact that people live longer in an environment where there is less cold, hunger and poverty.

Recent discoveries contradict the common thinking that age is essentially a matter of chronology, and that old age is a period of uselessness, whose problem can be shrugged away with the statement that the older person has lived his life. It is no longer possible for us to dismiss the illness of older people as a natural and inevitable part of being old. Such generalizations are a confusion of the symptoms of chronic illness, which is found equally in the younger group, with the more natural manifestations of old age. Actually many of these illnesses can be controlled on an individual basis. Nor can we any longer assume that mental deterioration, any more than physical disability, is characteristic of old age. The truth is, too often, that the older person has been thoughtlessly rejected as too old to do any useful work, to learn or to participate in the life around him, and that these experiences have helped to destroy his confidence, alertness and abilities.

The community has accepted its responsibility for the physical welfare of the older person. However, the need is for activity that will give him a feeling of adequacy and accomplishment, of usefulness and belonging; the need for companionship, recreation and understanding. Those things that tend to preserve the personality, have been given little consideration.

The older person today feels a separation, physical and emotional, from family and friends; he resents his loss of occupation which has created, and with some reason, a loss of dignity. We need to learn that complete senility is rare. We need to speak not of an old person, but of an older person. We need to know that many of the physical inadequacies of the older person are caused by neglect of his mental well-being. Fear of aging, rather than aging itself, frequently causes loss in mental and physical function. Creative energy is ageless. Can we be effective in sharing our understanding with the older person or must we be overwhelmed by the difficulties?

In the field of industrial medicine this presents a perplexity. More than half of our citizens now live past the age of 65. Today, proportionately 30% fewer men over 65 are employed than in 1900. Thus, millions of older people suffer a loss of economic status, which in turn creates a loss in social status, which in many cases is disproportionate to the actual decline in mental and physical capability.

The average income for all persons over 65, who have any income at all, was reported to be less than $1,000 a year. Enjoying retirement and the fruits of a long life on this sort of income is not simple. Nor can we say that the aged should always rely on family support. The younger generation has its own rights and has responsibilities, not only to parents, but also to their children. When earning ability is gone and savings are low, we see the role played by old age insurance and pension plans in reducing the anxiety and stigma attached to seeking help from relatives and charity.

Because many industrial firms retire their employees at a fixed age, we are beginning to note a rapid increase in mental illnesses which is fast becoming, along with cancer and heart disease, a major medical problem.

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For these and other reasons, compulsory retirement at a fixed age can no longer be regarded as a satisfactory policy. Management, labor and medicine should join forces in an endeavor to develop other criteria for determining man's work span.

In grandfather's day it was taken for granted that man kept working until he dropped. Then the pendulum swung far over until it was decreed that everyone was to be pensioned at a determined age. The important question is, just where is the older person to find his proper place after complete stoppage of work? A number of companies have adopted a flexible policy, which regards 65 as the norm around which the pension plan operates, but allow a few years' leeway either side of that age as circumstances may warrant.

Here is how one company handles this problem. Rather than lumping all employees into one category, each case is reviewed on its merit. In the year prior to prospective retirement a three-way conference is held in which management, the medical office and the employee concerned are brought into the picture.

In the first place, management properly reserves the right to indicate whether they can continue to find a place for this individual on their payroll after he has reached the pension age. A report from his supervisor shows the work record of the employee, his efficiency and dependability. Also, appraisal includes consideration as to whether his old job might still be open to him or has been slated for someone else. Thus management, without committing itself, does indicate whether it would be interested in this employee continuing in some capacity (or is expected to sever all work connections.)

The second phase of this conference is a thorough medical examination of the physical health and efficiency of the worker concerned, including his mental and emotional capacities. The report from the medical office will reveal if this individual is capable of carrying on at a full-time pace, should slow down a bit and taper off, or ought to call a halt to his working days.

Then the employee himself is consulted, to ascertain his feelings in the matter; and here again a wide variance of opinion is to be found. Remember that numerous older workers are looking forward to retirement; they have prepared for that day when they can stop punching the time-clock and can enter into a new program. But for the most part, persons in that age group want to keep working, either because they cannot live on the pension income alone, or because daily work has been their lifeblood and they dread the prospect of enforced idleness.

Although occasionally a problem may arise which requires delicate handling, the majority of cases will, as a result of this three-way conference, afford a fairly good indication of what work schedule ought to be followed by each older individual after reaching retirement age. It is neither a matter of the company arbitrarily releasing all employees after 65, nor of the worker taking it for granted he can continue as long as he pleases, but an endeavor to determine what is the best arrangement for all concerned.

So much for our method of handling cases under consideration at retirement age. Now let's take a look at some of the problems involved in this work scale after 65. At the extreme far end is full-time continuance at the old job. This I do not feel is generally to be commended, for it defeats the whole purpose of a pension plan if retirement age is disregarded and employees continue to work as long as they please. Because of this, even those companies which allow flexibility usually regard 65 as the normal age of retirement, with 68 or 70 the outside limit.

The economic factor also enters the picture should the worker start to draw his pension at 65 on top of his regular full-time pay. This means that at the time when an oldster should be learning how to live on a reduced income, he is drawing more money than before. The temptation to live up to his new affluence is wellnigh irresistible, and then the sudden transition a few years later from this high income level down to pension alone is a strain that few can withstand. While the company cannot refuse the pension to which he is entitled, perhaps the wise procedure would be to defer payments until such time as he does retire.

At the recent open hearings of Sen. Desmond's N. Y. State Committee on Aging, Dwight Sargeant of the Consolidated Edison Company reported the results of a change which their company made in its retirement policy. Until the close of 1952 their pension plan called for arbitrary retirement at 65. Then, realizing that this was no longer defensible, it amended the plan to allow employees to remain on after that age, if certain conditions were fulfilled.

First of all, the company excluded all supervisory or executive employees because they were regarded as in a position to retire satisfactorily. For personnel below that level, three requisites had to be met. There must be a need for the employee. The employee must have a satisfactory performance rating in his job over the past three years. And he must have had a better than average sick absence record for the past three years.

A total of 385 employees of retirement age were reviewed in the year 1953. Of this number 155 were turned down because of physical limita-

tions or absentee records, 50 were rejected because of being in a supervisory capacity, leaving 180 persons who were qualified for consideration. Of this number 114 were classified as suitable to remain but were not needed, so their names were dropped from the list, leaving 66 suitable persons who were asked to remain. The significant thing is that of the 66 who were informed they could continue at work, 20 replied they were not interested and preferred to retire. That left 46 who carried on at their usual job for another year, at which time their case would be reviewed for further continuance. Consolidated Edison acknowledges that one year is far too short a time to arrive at any definite conclusions, but its management is satisfied with developments. So far the plan has been limited to workers continuing full time at their old jobs, and no attempt has been made as yet to transfer to other jobs or shorter work days.

While we congratulate Consolidated Edison on this forward step, there is one aspect of their program to which I was forced to take exception. In his New York paper, Mr. Sargeant stated that item number nine of their procedure declares:

"If requested by the department, the employee must pass a satisfactory medical examination, with a favorable prognosis as to the time he might lose on account of sickness." Then Mr. Sargeant went on to say with pride, that not a single such request had been made during the entire year. "We have taken the very simple position," he said, "that if the individual has been doing a satisfactory job and appears to be physically all right we see no reason why we should not permit him simply to continue. We have not required a medical examination at 64 or 63, so why ask for one at age 65 if everything appears all right?" But surely the answer is obvious — for the employee's own good.

In contrast to Consolidated Edison's policy of allowing a selected number of their over-65 employees to continue at the same job, let us look at another approach to this problem, as suggested by Robert R. Updegraff of Scarsdale, N.Y. in his article entitled, "Should Retirement Supplement Retirement?" appearing in the November, 1955, issue of *Dun's Review and Modern Industry*. Updegraff presents a strong case for a policy which calls complete severance from his old job for every worker reaching pension age, but then allows for the retiree to be taken back again on the payroll in a different category.

At 65, or some other agreed age, the employee relinquishes all claim to his old position and goes on pension. Should he wish to retire of his own accord, or if the company doesn't feel it has a place for him to continue, they sever connections and he is free to make any other arrangements he pleases. But if he would like to continue, and the company is agreeable, then he is rehired and assigned to a job similar to his old occupation, but of lighter nature. A manager of a big city branch takes over a small suburban branch, a salesman is given a lighter territory, a supervisor is used to train younger personnel.

Updegraff rightly maintains that all such reassignments must be on a practical, profitable basis, for the benefit of both management and labor. Sentiment should not lead to finding any kind of a job for "good old Brewster." Many of the so-called consulting arrangements, so popular today, involve the old boy being called in only occasionally, and then his advice is often disregarded, which results in his feeling far more frustrated and useless than if he had retired while still at the height of his prestige and power.

Personally I have never liked the term down-grading, for the word in itself has a depressing connotation. Status is important to the older worker and any down-grading is regarded as a loss of prestige in the sight of his fellow-workers. Occasionally we hear retirees state they would take any kind of a job at all, just to remain on the labor force; as one foreman put it, "I started as a young sqirt by pushing a broom and I can finish up that way." Even so, it isn't a fortuitous arrangement where a man is demoted and has to take orders from those who were formerly under him. Far better to follow Updegraff's suggestion of placing the "Rehiree" in some other department which has no connection with his previous position.

It may be a case of fools rushing in where angels fear to tread, but I am in favor of this tapering-off policy. Whereas Consolidated Edison limited their new program to full-time continuance at the old job for a selected group, and Updegraff advocates his Rehiring policy to be tried first of all with salaried employees, I see no reason why everyone from top to bottom levels cannot be embraced in a tapering-off policy.

Summary

EFFECTIVE industrial programming, whether it be preparation for retirement or retention at the work place, requires thorough research that will eventuate in more definitive information as to the mental ability, personality and physical fitness of older industrial workers. Only through the acquisition of enlarging information may industry devise adequate policies as to worker retirement. Our national health goal is the maximum number of healthy, happy and informed individuals of every age. The purpose of the community is the elevation of human life. The acceptance of this responsibility is a historic de-

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velopment. Step by step, society has taken to itself the responsibility of public health, public education, public welfare, provision for the care of the defective, the dependent age and the unemployed.

While industry has only limited responsibilities in the overall activities just mentioned, it does have a unique responsibility with respect to the retirement of its workers. Rapidly changing techniques in industry make it necessary for industry to develop new methods and tests that will reveal the abilities and capacities of older workers, so that retirement may be accomplished in terms of the physiologic status rather than by any arbitrary age level.

Educational institutions are ready to help industry devise programs. In most cases industry is not yet ready to accept changes in their established policies. At all ages, people deserve to enjoy the warmth of good relationships, the satisfaction of a full and productive life. Industry can do much in the provision of these basic needs.

Charles Turner Thackrah

ON OCTOBER 2, 1815, the name of John Keats was entered on the register of students at Guy's Hospital: two days later another name, that of Charles Turner Thackrah, was added to the same register. These two young men (both were born in 1795) were to have certain things in common: both qualified the following year; the peace of mind of each was disturbed by an unhappy love-affair; each contracted tuberculosis and, at an early age, succumbed to it. There the resemblance ceases. For Keats abandoned the practice of medicine very soon after taking it up, and renounced his "plasters, pills and ointment boxes" (to which the derisive critics of *Endymion* nevertheless bade him return): Thackrah plunged wholeheartedly into his profession. Keats's associates included Shelley and Leigh Hunt, probably Lamb and Hazlitt: Thackrah rubbed shoulders with millhands and cotton operatives. And while one gave us *The Eve of St. Agnes* and *Ode on Melancholy*, the other was destined to write one of the most remarkable medical textbooks in the English language. In this book, first published in 1831 and lately reprinted, Thackrah examined the health, working conditions, and recreations of those employed in several hundred different trades. Some of these occupations will be unfamiliar to the modern reader; and Thackrah's remarks on others may not seem so apt today. As, for example, his digression on medical students: "The influence of putrid exhalations is shown . . . by the effects of a dissecting-room. Students are at first annoyed by diarrhoea; but subsequently, if they be steady and temperate, and avoid wounds from the hook or the scalpel, sometimes become robust. We have remarked several pupils to look best, and eat most, when they are dissecting." In discussing the qualified practitioner, he is more convincing: "Night calls are generally thought to be very injurious. I think the evil less than the public and the profession suppose: for, if we observe those who have for thirty or forty years been much engaged as accoucheurs, we shall find them as robust as others." But Thackrah's book is not to be treated with levity. In its pages are some of the earliest references to miners' nystagmus, to the periodic ague which afflicts brass-founders, and to the evil effects of bad posture and of the inhalation of dust. And who can read unmoved, Thackrah's description of how he stood in a Manchester street and "observed the streams of operatives as they left the mills . . . the children were almost universally ill-looking, small, sickly, barefoot and ill clad." Many of these children, he said, looked no older than seven. In one mill he visited, 1500 persons were employed, and more than half were under the age of 15. Their work began at 5:30 A.M. and continued, with two short intervals, to 7 P.M. When he wrote in this vein Thackrah attracted attention from laymen as well as physicians, and, as Dr. Donald Hunter has pointed out, his monograph played an important part in stimulating the factory and health legislation which mitigated some of the worst features of the Industrial Revolution.

—From *London Lancet*, September 7, 1957.

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The Fundamental Question of Dermatitis at Lone Star Ordnance Plant

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THIS discussion relates to nonrecovery of occupational dermatitis. I am presenting a recent case which illustrates and emphasizes this phase of the problem. This is one of four such cases that have caused us concern at Lone Star Ordnance Plant.

Case Report: J.A.B. This employee first reported to the dispensary on April 2, 1953, complaining of pains in his chest of three month's duration. He was referred to his physician who made a diagnosis of cardiospasm and pylorospasm. He returned on November 19, with a recurrence of these complaints, and was again referred to his physician for attention, since his complaint was in no way occupational. In the meantime, on June 1, 1953, he reported with a rash on his hands. A diagnosis of contact dermatitis was made and was treated as an occupational case. He immediately improved but never recovered entirely. He was employed in the garage around greases and oils, and it was assumed that he was allergic to the materials with which he worked. On September 16, 1953, scrapings and smears were made of the rash area and evidences of fungus growth were noted. No bacteria were found. Inasmuch as improvement with antiallergic treatment had occurred, it was thought that he had had an occupational contact dermatitis associated with a fungus infection which was thought not to be occupational. He improved and on November 12, 1953 was discharged as in need of no further treatment.

On November 19 he reported with a marked recurrence of the rash and was referred to a dermatologist, who made a diagnosis of a fungus dermatitis associated with a secondary infection. In the meantime, our safety department had unearthed a history that this man had suffered with a dermatitis before he was employed. He had denied this to the medical department, going so far as to sign a statement that he had never had allergic manifestations. However, it was learned he had been treated by a civilian physician and had also been treated by the Veterans Administration for a service-connected ailment of fungus infection, with a history of contracting the fungus in the South Pacific during the war. We took the position that he had recovered from the contact dermatitis which he may have developed at our plant, and he was informed that his trouble was not occupational. This attitude was confirmed by competent consultation with a certified dermatologist.

This man sued our company and recovered damages on the testimony of a general practitioner that the infection was in the blood stream and that he might suffer from it for three or four years.

Comment

WHAT we wish to emphasize is the need diligently to search for the reasons when cases of industrial dermatitis fail to heal after competent treatment has been provided. As you know, the average duration of moderately severe contact dermatitis is two to four weeks. We are concerned with cases in which the periods are more protracted — six, 10 or 12 weeks. We are quite concerned with a small percentage of cases that fail to get well in months or even years. The questions that need answering are: What are the causes of the conditions, and why do they fail to respond?

Some answers to these questions which we have developed are: Other types of allergy may be complicating factors, such as urticarial tendencies and red dermographism. These may indicate that the patient has an underlying food allergy which may raise the level of reactivity of his skin. Here is a mixture of occupational and nonoccupational conditions which are always controversial.

Histories of hay fever and asthma are important in job placement where exposure to metals and chemicals is anticipated. Many of these cases terminate in atopic dermatitis. Proper placement is the best approach to this situation, as a preventive measure.

Presented at Ordnance Industry Physician's Seminar, Frankford Arsenal, Philadelphia.

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A third reason for the failure of healing is that secondary infection becomes infectious eczematoid dermatitis with the development of pustules. This is fairly common and presents the vexatious condition of recurrent acute-chronicity in many cases.

Still another cause is the development of dyshidrosis in those who have sweaty skins, especially the hands. Dermatitis venenata apparently produces a closing off of the sweat apparatus so that adequate sweat is not delivered to the skin surface.

Morris points out and stresses the fact that one of the most frequent reasons why an alleged occupational dermatitis does not recover is an incorrect original diagnosis. This may have been the case with our patient, J.A.B. The original diagnosis was based primarily on the improvement that followed antiallergic treatment rather than on scientific investigation, which perhaps should have been made in the beginning rather than later on, as was finally done when he was referred to the dermatologist.

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Ulcerless Decision Making

DECISION MAKING will never be an easy, routine job, but it doesn't have to involve mental turmoil and jagged nerves, either. Here are some tips for easing the strain of decision-making chores, suggests Ernest W. Fair, in *Industrial Marketing:* 1. *Don't put it off.* That always leads to trouble and makes the final decision more difficult. 2. *Consult and check.* The more you use the thinking power of other people in the company, the greater becomes the value of your own judgment. 3. *Once you've made the decision—forget it.* Mulling over the rightness of every decision invites ulcers in a hurry. 4. *Get into a relaxed frame of mind.* Decisions made under stress often result in the greatest headaches. 5. *Don't try to anticipate everything.* Good decision making naturally calls for some anticipation of end results, but the supervisor who tries to foresee every tiny, remote possibility only burdens his thinking processes unnecessarily. 6. *Be decisive.* When you can't make up your mind, tension mounts and the problem becomes much more difficult. 7. *Eliminate the fear of failure.* This is the number-one cause of physical and mental strain, and must be conquered before consistently sound decisions can be made. 8. *Don't make snap decisions.* Never let yourself be put in the position where you have to make a spur-of-the-moment decision. Facts you fail to consider will almost always show up to make your decision look bad.

—From *Supervisory Management*, July, 1958.

Industrial Medical Association

President's Page

IT WILL be a source of satisfaction to all members to learn that with the installation of an Assistant Managing Director at IMA headquarters, the functions of IMA and OHI are now being effectively pursued from the same office, without the duplication of effort, service and overhead incidental to separate offices.

This new unity allows our Managing Director more time and help to pursue the pyramiding IMA activities in a vigorous manner. The introduction of certain office equipment in the paperwork area means substantial savings in clerical work and better communication with our membership. Although this has been set up only since the first of the year, we are impressed with the effective and competent manner in which our staff manages their various responsibilities. We firmly believe that the quality of our headquarters personnel compares favorably with the business staff of any other medical association, or with a corresponding business organization. We are looking forward to a continuing high level of accomplishments in the future.

The Occupational Health Institute also is progressing through reorganization. Through liaison with several other medical associations, the practical problems involved in establishing and operating a Joint Commission on accreditation of industrial health services are being actively discussed and transacted. We are planning to bring these negotiations to a favorable conclusion at an early date, and hope to begin functioning under the revised organization before our annual meeting in Chicago next April.

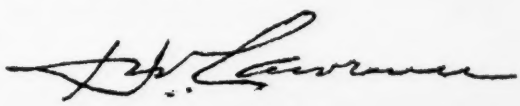
The appointments of the IMA counselors and committees are now complete. New organization charts have been distributed, and the way has been cleared for a busy eight months before our next annual conclave.

In addition to meeting with various committees, your Executive Committee held an all-day meeting at the Chicago Headquarters on Saturday, June 14th. The next Executive Committee meeting will be held in Pittsburgh on Tuesday, October 28th, and the Board of Directors will meet in Chicago on November 8th.

BY THE TIME you read this you will have received your first letter from the Chairman of the Membership Drive Committee. We sincerely hope that your response was prompt and generous. The drive is definitely under way and we hope to submit a favorable report to you later.

The importance and the far-reaching effects of a vigorous membership drive cannot be overemphasized. The practice of industrial medicine in all its multiple aspects, from the first-aid care of injuries sustained on the job to the subtle manipulation of environments to render them less hazardous and more comfortable, has proliferated into areas undreamed of 30 years ago.

A perusal of the American Medical Directory showed that about 5,300 physicians listed a special interest in the practice of industrial medicine. Of these, only about 3,300 are members of the Industrial Medical Association. That means that there are over 2,000 physicians in the United States who practice industrial medicine full or part time who are not members of the association of their specialty. It is conceivable that many of these doctors are completely unaware of the existence of IMA. It is our responsibility vigorously to solicit the membership of these men. Our motive for this is not a selfish one. These 2,000 twlight area practitioners of industrial medicine need to become associated with the organization which fully reflects their function. They must be apprised of the swiftly occurring innovations in the field, and they must have an organization through which they may be in sympathetic communication with the leaders in their chosen profession.



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Science Miniature

An Epoxy Resin Dermatitis Outbreak

E. A. TERRY, JR., M.D.
Louisville, Kentucky

FORTY cases of epoxy resin dermatitis, representing an attack rate of approximately 50%, occurred early this year in workers exposed to a resin containing a polyamide catalyst which is nonvolatile at room temperature. The resin was being used as an adhesive to bond copper tubing and strip-aluminum. The average duration of exposure prior to development of the rash was 36 days. Eight men of the 40 developed a definite sensitivity and were removed from further contact with the resin. Treatment of the mild cases was symptomatic. The sensitized individuals were treated with steroid preparations, both locally and systemically. Maximum efforts have been directed toward prevention of further cases by minimizing personal contact with the resin. Depending upon the exposure, this involves the use of gloves, sleevelets, coveralls and protective creams. Specific attention has been paid to frequent washings at the work station of exposed skin with soap and water or waterless cleaners. A substitute material or process is being sought by job planners and manufacturing engineers.

Books

Pocket Poison Portfolio

SIGNS, SYMPTOMS AND TREATMENT OF CERTAIN ACUTE INTOXICATIONS: WM. B. DEICHMANN and HORACE W. GERARDE. Charles C. Thomas, Springfield, Illinois, 1958, pp. 154, $3.75.

This second edition and third printing marks this small book as having had acceptance. There are reasons for its approval by physicians, nurses and safety engineers; (1) it is condensed and pocket size with semiflexible cover (2) its contents are alphabetically presented, permitting no fumbling in emergencies; (3) it includes numerous trade named products with identification as to chemical nature; (4) its contents with some exceptions are authentic.

The title of this manual is cumbersome, reflecting evil on the publisher. While the coverage may not be exhaustive it is sufficiently so that a better title might have been The Acute Intoxications, with the subtitle Signs, Symptoms and Treatment. Since "signs" are but objective "symptoms," the title might be made that much shorter. Then somewhere in the preface the modest authors well might indicate, as they have already, that the coverage might have been made more extensive.

The most difficult book to write with exactness is the sharply condensed one in which there is continuous competition between needed words and waning space. This book is the victim of its design, but this self affront does not destroy it. The speckpicker would complain as to item 146, that it is anatomically impossible for fluorides to induce de novo mottled enamel in an adult, although coloration might arise. Item 104 labeled "detergents" describes one chemical type of detergent as all embracive, ignoring other synthetic types and overlooking true soaps as detergents along with water. On page nine the first recommended step on eye emergencies is the examination for vision. Often the first requirement is the immediate and copious flushing with water. The Ortho-Rater or the Snellen chart is no laudable substitute. Item 184 devoted to lead, characterizes chronic lead poisoning in children as "Lead Encephalopathy." Such is but one manifestation or form of lead poisoning in children. In item 225 the case against nickel chiefly is built around garter and brassiere buckles. This levelling off at distaff underdress possibly should give way to the more often offending nickelplated spectacles and watch bands. They at least are at more readily observable sites.

Offsetting such soft spots in compilation, the authors do something not heretofore encountered. They call attention to the fact that in many products some contents that may be labeled "inert ingredients" are far from inert as to toxic properties. A brief list of such is provided including for one example, kerosene, which by no means is harmless under all circumstances.

Diet and Heart

DIETARY PREVENTION AND TREATMENT OF HEART DISEASE: J. W. GOFMAN, A. V. NICHOLS and E. V. DOBBIN. G. P. Putnam's Sons, New York, 1958, pp. 256, $3.95.

Coronary heart disease has become the most prominent cause of death and early disability in the United States. As a result both the intelligent public and the medical profession are intensely interested in knowing the best measures available for preventing this disease.

Fortunately, a tremendous amount has been learned in the past 10 years about the basis for heart attacks through intensive worldwide research. This has made possible a reasonable, logical and practical program for the prevention of premature occurrence of this disease.

Although the press has endeavored to inform the public of the new research developments in heart disease, some reports are ofttimes internally contradictory, and inconsistent with other reports. Thus, the intelligent individual has had great difficulty in ascertaining what we do know about heart disease. The large volume of publications in the scientific and medical literature has even caused the physician some difficulty. Furthermore certain trivial issues have been belabored in some writings, thus confusing the true status of our knowledge. Clarification and interpretation are needed for the public and the physician.

The authors of this book feel that intelligent lay individuals and physicians can justifiably request that the pertinent information be assembled in one place in understandable form.

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Industrial Medicine and Surgery as the International Journal in Occupational Health

FOR A NUMBER of months this Journal has carried in its secondary title on its masthead the word "international." That is indicative of no casual innovation. Instead it reflects a newly added dedication, an expanded territory of endeavor, a determination to reach into the entire world of industry. For a long time this Journal has sent subscriptions to all industrial countries. For an equally long time this Journal has maintained overseas editors in all major industrial countries.

Occupational health has become international. On an average, some international assembly in occupational health occurs monthly. The coming Inter-American Conference on Industrial Medicine in Miami is representative of the many. Not always are these conferences staged by any long existing scientific association. More often they are arranged on a group sponsorship basis with no purpose to perfect an enduring organization. Some others represent stable groups with long records of achievement. Into this category falls the International Permanent Commission on Occupational Health, best known for its triennial congresses, the thirteenth of which will be brought together in New York in 1960.

So far as known no international body in occupational health publishes its own periodical, although some few publish and promulgate proceedings of their scientific activities. For the majority of these international enterprises the publication of a scientific journal is impractical and undesirable. Yet in consideration of the over-all developments, the international occupational health situation calls for better dissemination of scientific disclosures, wider coverage of news items, improved liaison and cohesive effort at the international level. Hence the determination of *Industrial Medicine and Surgery* to place itself at the disposal of international health without in any degree lessening its activities in its present and foremost function of serving the industrial physicians of the Americas.

In this departure *Industrial Medicine and Surgery* does not seek to become the official organ of any one international body in occupational health to the exclusion of all others. Rather, the desire is to be accepted by all nations as spokesman for pursuits in occupational health that have international significance. Without limit, the range is from India to Israel and from Alaska to Chile. Through the instrumentality of *Industrial Medicine and Surgery* all that is good in occupational health in Chile may contribute to the good of India and the same in reverse. The need is for enlarged communication facilities, and *Industrial Medicine and Surgery* is an instrument of communication.

No radical changes in the present format of this Journal are contemplated. Slowly there will be adjustments to manifest concern. Although the English language has become the chief scientific speech of the world, should the appearance of some articles in other languages such as French, Spanish or German serve useful ends, then that will become an object of consideration.

Apart from its objectives, which are common to all nations, occupational health is characterized more by heterogeneity than by homogeneity. If more homogeneity is essential to true inter-

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national scientific integration, a forceful medical press may become a common denominator to that end. This Journal accepts as an obligation the pleasant task of world-wide dissemination of the records of achievement in occupational health.

Management's Attitude Toward Occupational Health

FOR 15 YEARS the *Health Yearbook* has compiled the notable publications on health that appeared yearly in American periodicals including some nonmedical ones. The editor, Oliver E. Byrd, Professor of Health Education, Stanford University, (Stanford University Press, $5.50), directs for 1957 a fair share of his overall health coverage to occupational health. One of his subdivisions relates to industrial management's estimate of occupational health. The following is one man's appraisal of the 1957 situation: "E. Sidney Willis, consultant for the General Electric Company of New York City, says that it is not an idle boast of his company when it says that its employees are five times safer at work than they are outside. Millions of dollars have been spent on safety devices to protect workers from injury and on other working conditions affecting their health.

"Management has taken great strides in the field of industrial medicine. Better management support, professional services, clinical facilities, and control of the environment constantly are being effected.

"Management is showing an increased interest in the field of nonoccupational health.

"It is the conviction of management that medical insurance should provide protection against medical care on a broad front. This insurance should provide both for ordinary illnesses and for the catastrophic illness as well as for medical costs of all types in or out of the hospital. The protection of health insurance should be a flexible one. It should be adaptable to various situations and should provide for different complications of illness.

"It is also the viewpoint of management that insurance should provide aid only where it can be of real tangible help. Individuals can afford to pay the small and infrequent costs of minor illnesses. Insurance can help in the case of heavy financial burdens or where small individual costs occur so frequently that they begin to mount to serious proportions.

"Management also believes that normal medical expenses have a definite place in the normal living budget. No one feels wronged when he has to pay for recreation, or buys a car that depreciates rapidly, or has a TV set delivered to his home on the installment plan. He should accept certain expenses for medical care.

"It is the conviction of management that the individual should maintain a direct and continuing interest in the quality and cost of his medical care through direct participation. The use of prepayment plans, for example, which are a form of installment buying, are part of the picture.

"It is also the viewpoint of management that the best individual medical care results from the private practice of medicine under which there is a free choice of doctor and hospital services. Management recognizes the importance of government in areas of general public health and in certain regulations affecting general public health, but individual medical care is considered a private matter on which governmental control could do nothing but detract from the quality of the service.

"Management in general is interested in providing the best possible personal care for workers at costs consistent with sound social and business objectives."

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